

The **CRUSHED STONE JOURNAL**

In This Issue

Some Current Aspects and Probable
Future Developments in the Agricultural
Limestone Project

■
Expansion and Contraction of Concrete

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America---A Going Concern

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Popularizing An Industry

March • 1931

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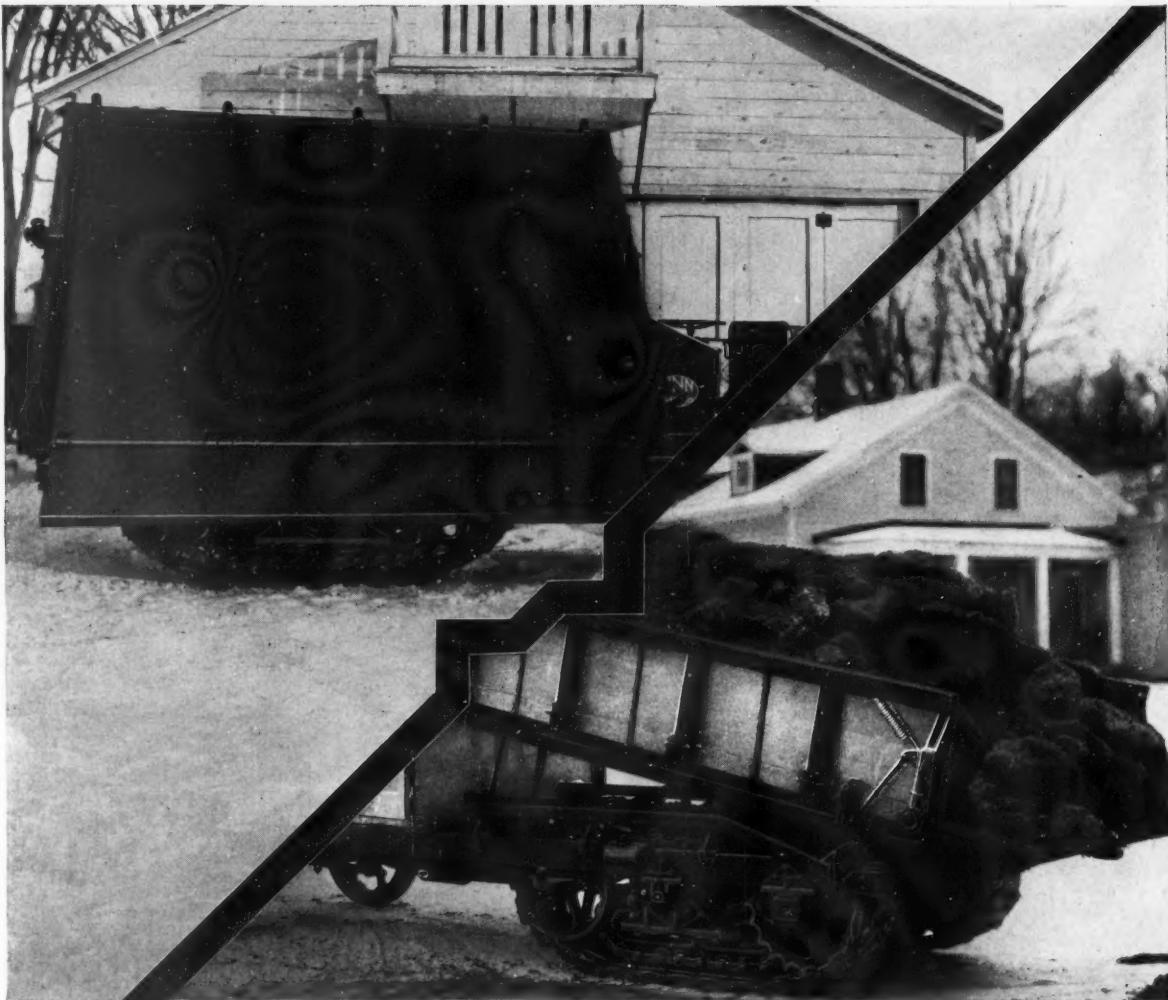
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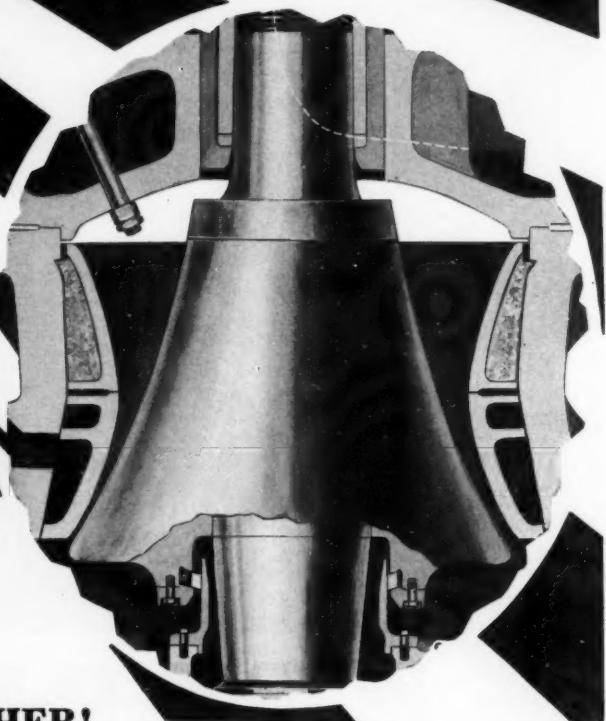
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THE CRUSHED STONE JOURNAL

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MARCH, 1931

Some Current Aspects and Probable Future Developments in the Agricultural Limestone Project¹

By J. R. BENT

Director of Limestone Phosphate Department,
Illinois Agricultural Association, Chicago, Ill.



I CONSIDER it an honor and a real privilege to be with you on this occasion and to be afforded this opportunity to discuss with you, for a few moments, some current aspects and probable future developments in the agricultural limestone project.

There are many sides to the agricultural limestone project, from any one of which I might approach the subject. It would be very easy to drop into the rut of merely proclaiming the value of agricultural limestone to the individual farmer. That is a phase of the subject which is of great importance but which has been stressed frequently and far and wide; while other phases, fully as important, have been relatively ignored. I might dwell at length upon the effect of the current conditions of the past year, with particular attention to the severe drought and the financial inability of the farmer. Again, I might discuss with you many matters of importance bearing upon grades of material, both chemical and physical and the ways of evaluating the same. I might outline some of the many problems involved in production, marketing and utilization.

Agricultural Limestone as Related to Our National Life

But important as these various phases of the matter are, I have chosen instead to dig deeper into the sub-

ject and endeavor to draw for you, as best I can, a picture which has taken possession of my own mind. It is a picture of agricultural limestone's place in our national life; its importance not alone in the development and conservation of soil fertility and agricultural welfare, but especially its place in determining our ability to continue to exist as a prosperous, healthy and happy nation.

If some of the statements which I shall make may seem to you to be critical, I ask you not to interpret them as being prompted by any spirit of complaint or willingness to be fault finding, but rather to my desire to contribute, so far as I am able, to constructive analytical thought for the good of all.

So much has been said about the ills of agriculture, during the last ten years, that any further comment along this line hardly produces a response, unless it be a feeling of fatigue, because this mournful note has been sounded so frequently. The general business depression of the last year or more has put commerce, manufacturing, transportation and other branches of our national activities onto the stage with agriculture, and in so doing has served somewhat to divert the limelight from the latter. Serious as is the plight of business in general, and deep-seated and difficult of solution as are some of the factors which contribute thereto, still most authorities believe that these conditions are temporary and that we will emerge from them

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in due time if we but fix our faith, determination and efforts on that goal. The ills of agriculture, however, are not so easy of solution. The most important causes are fundamental and, so far, have not yielded adequately to any effort that has been made to correct them. The fact that a problem is difficult, and many attempts have failed to find a remedy, is no reason why we should henceforth ignore it or cease our efforts toward a solution. We should dig deeper and deeper and be prepared to sacrifice more and more in time, thought and effort, in our determination to find an adequate and workable remedy. I am making no plea on behalf of agriculture selfishly. Agriculture is not an independent field of endeavor which concerns only those who are directly engaged therein; it is the corner-stone in the foundation upon which our national development and prosperity has rested. Throughout our national history our great statesmen and thinkers have given expression to their recognition of this fact.

George Washington, in a message to the Congress, said, "Agriculture is of primary importance."

Abraham Lincoln, in one of his messages, said, "Agriculture is the most valuable of all arts."

Daniel Webster said, "Let us never forget that the cultivation of the earth is the most important labor of man. Unstable is the future of a country that has lost its taste for agriculture. If there is one lesson of history which is unmistakable it is that national strength lies very near the soil."

Roosevelt, in establishing his country life commission, said, "No nation has ever achieved permanent greatness unless this greatness was based on the well-being of the great farmer class." . . . "Our civilization rests at bottom on the wholesomeness, the attractiveness and the completeness, as well as the prosperity of life in the country."

Lowden made the statement, "The agricultural problem is not a class problem as many seem to think. It involves the very existence of our institutions. No man can contemplate the future of America with assurance unless America is to remain fundamentally an agricultural nation."

Overproduction is Chief Difficulty

What is the plight of agriculture? Stated in one word I would say it is *overproduction*.

How great is this overproduction? Is it merely temporary in character or is it likely to continue indefinitely? What is its effect upon agricultural welfare and the purchasing power of the farmer? What significant bearing does it have upon the use of fertilizers in general, and of more importance to you, what should be its effect upon the need for and probable use of agricultural limestone? Is it true, as many seem to think, that any increasing of the productivity of the soil, by the use of limestone, the growing of legumes and the application of commercial fertilizers and fertilizing materials, can result only in a further increase of total production with a consequent

further increase of the burdensome surplus which is breaking the back of agriculture and thus complete the ruination of the farmers who are progressive enough to adopt these modern methods? These are the questions which I would like to discuss briefly with you today. These various questions are inseparable; they are all fundamental parts of the one great problem and it is because they have such a vital bearing upon the limestone quarrying industry, and have received relatively so little attention and analytical thought, that I feel they are deserving of your time and attention today.

Extent of Overproduction

First, how great is this overproduction? Speaking in terms of grains alone (corn, oats, wheat, barley and rye) and using the last five years' average as our criterion, it has been estimated by competent authorities that the production in the United States is roughly 15% in excess of the domestic needs. Grains are somewhat interchangeable and a surplus or shortage in one has some bearing upon the others; however, most of the surplus, in the case of grains, in the last analysis reflects its effect in wheat, which is the one exportable grain and must compete in the world-wide markets under the laws of world-wide supply and demand. It does not take a very large surplus of any commodity, manufactured or agricultural, raw or finished, to disproporionately, and more or less disastrously depress the market for that commodity. In the case of manufactured products controlled by relatively few individuals or corporations, the problem of a hurtful surplus is a relatively simple one and should be, comparatively speaking, avoidable. The solution lies in controlled production to fit demand, and has been invoked successfully repeatedly. But just in proportion as a commodity is produced by larger numbers of productive units, and just in proportion as the producers are unorganized, the problem becomes more serious. It reaches its maximum development and acuteness in the case of agricultural products. The uncertainties of weather and the part nature will play complicate the matter further and greatly. Is surplus agricultural production temporary in nature or is it basic and more or less permanent? This cannot be answered without reference to world-wide statistics and trends, so I feel I am justified in seeming to digress at this point sufficiently to give you a few facts and figures made available through Federal Government agencies.

Influence of Growth of Population

Obviously the surplus is but the difference between production and consumption, therefore the size and growth of population has a very great and direct bearing thereon. During the past century the United States has increased nearly tenfold in population, but since 1921 the rate of increase in this country, has shrunk 22%. This decrease in the rate of growth is

largely associated with the great shift which has taken place between rural and urban population. The size of the average city family always has been smaller than the size of the average rural family. The city family is seldom more than a social unit and is rapidly ceasing to be even that. The rural family, on the other hand, continues to be both a social and an industrial unit. Even though the relative rate of growth may be slowing up, it is estimated that our total population will continue to increase until about 1960, at which time we will reach a maximum of 160,000,000 people and from that time on will begin to decline.

The northern and western European nations in the past have been markets for American agricultural products but during the past twenty-five years the population in this portion of the globe has remained substantially stationary while agricultural production in that area has been increased, through modern mechanical methods and the application of the results of scientific research. Henceforth these countries may cease to be large markets for us.

The population in Russia has been growing rapidly and promises ere long to absorb its present surplus of grain, which at present is such a potent factor in depressing the world market for wheat.

Asia continues to increase in population and is just entering upon an era of industrialization which is likely to bring about great changes in the amount and character of food consumed by this great portion of the human race.

Southern Europe has shown some tendency to increase in population which possibly may out-run the increased agricultural production in those nations, notably in Italy, under the ambitious program outlined by Mussolini.

Population Not Only Factor

There are other factors, however, besides population which affect consumption of agricultural products. As labor has become more and more emancipated by the mechanical developments of the age, heavy consumption of foods, of the fuel type, has become less per capita. There has been a very pronounced shift from the human consumption of cereals toward the consumption of sugar, milk and meat. The consumption per capita of cereals has decreased 100 pounds per annum or 30% since the pre-war period 1909-1913. Sugar has shown a 35% gain; milk 24% gain and pork 15% gain. Domestic consumption of cotton per capita has remained stationary, largely due to other uses being developed which have offset the reduction in its use for clothing. There has been an increased consumption per capita in tobacco and vegetable oils. Some of these shifts in character of consumption have brought about regional shifts in production areas but so far these have not been great. There are other factors, such as erosion and depletion of soil fertility which are likely to have more far-reaching effects upon area shifts. Summarizing these facts as to consump-

tion, the trend in exports has been a rapid decline recently, while in the next 30 years the increase in population of our own country will require some slight increase in crop area. Domestic needs will increase about 30% in that time.

Now, what are some of the facts pertaining to production? Previous to the World War there was a large expansion of crop area in the United States. There has been a slight further gain since the war. Previous to 1910 there was a steady increase in the per acre yield. Since 1910 this has gained a little.

The development of mechanical farming; the development of more productive crop varieties; the development of higher classes of livestock, which make more efficient use of feeds; more scientific methods of tillage, and, lastly, more efficient and conservative methods of harvesting, all have been effective in offsetting the depletion in soil fertility. They have enabled farm production per man to increase 25% since the war and 35% since 1910.

Is it any wonder with production per man increasing; with total production in excess of demand; and with the surplus seriously depressing the market and making the agricultural industry unprofitable and unattractive; that we should have reluctance on the part of the farmer to use fertilizers and soil-building methods? I feel keenly that as a nation we have either drifted, or have been forced into an attitude of indifference toward the problem of soil fertility which, if allowed to continue, will prove suicidal in the end.

Soil A Valuable Natural Resource

The late Dr. Van Hise, formerly president of the Wisconsin State University and himself a noted geologist, made the significant statement that, "The surface layer of soil, manufactured by the processes of nature through millions of years, is the most precious resource of the nation. Of all our duties to our descendants that of maintaining the soil unimpaired in thickness and in richness is the most serious."

Mrs. Newton B. Ashby, sister of the late Henry C. Wallace, former Secretary of Agriculture, said, "The farmer is picking the pockets of his grandson's first pants. He is robbing future generations. The farmer is the keeper of the earth, and the hope of the nation's food supply is conservation of the soil. But the soil could be used up in one generation if not farmed properly."

Before turning to the last of the questions I have outlined; that is, "What bearing does the crop surplus situation have upon the need for the use of limestone?" I would like to take one more side trip with you and point out what has been going on in the way of depletion of our soil resources.

Soil Resources Rapidly Being Depleted

Dr. O. E. Baker, Senior Economist, Division of Land Economics, Department of Agriculture, says that "The

estimates of well informed persons indicate that during the brief space of 50 to 150 years, varying with the region, since the forest was cleared or the prairie sod plowed for crop production, probably one-half, possibly one-third of the original soil resources of fully half the arable land of the nation has been lost. Moreover, it appears that the time is rapidly approaching when, owing to soil losses, the cultivation of many farms will be no longer profitable, if indeed possible, and agricultural production will decline in numerous localities."

He further states that the loss from all sources (cropping, leaching and erosion) "appears to be at least 5,000,000 tons each year of nitrogen, 3,000,000 tons of phosphoric acid, and 28,000,000 tons of potash and the loss may be many times that amount."

Gullyng is not the only form of erosion; it is but the evidence of erosion in its late stages. Even more serious, perhaps, is the erosion which is not so visibly evident, which takes place in the top soil, without gullyng. Valuable food elements are carried away in suspense as well as in solution but the top soil with its organic matter resists, for awhile, the evidence thereof by gullyng. The sub-soil which lacks the organic binder, once reached in the eroding process, yields rapidly to gullyng. A Mr. Mason (engineer) made a careful comparison of the thickness of the top organic soil in fields which have been cultivated as against uncultivated neighboring land on the Illinois Central right-of-way and found that on the best level-lying relatively fertile Illinois land about eight inches in thickness has disappeared during the time it has been under cultivation.

It has taken many thousands of years for nature to make this soil from the original rocks. When it is gone man cannot replace it during the course of many life-times. Man, however, by proper methods of tillage and soil conservation, largely can prevent further loss through erosion, cropping and leaching and can maintain for posterity this God-given heritage. But will he do it, if by so doing he is increasing the disastrous effect of crop surpluses?

What are some of the facts pertaining to leaching? It is very hard to get facts for the United States as a whole. Different states or portions of the country differ very greatly in topography, type of soil, crops, climate, rain fall, etc., and adequate experiments have not been conducted in all parts of the country. However, the Kentucky Experiment Station has done some very valuable work in the analysis of the Mississippi River waters and measurement of its flow at various stages and from the facts so determined have calculated that 22,000,000 tons of the pure element calcium and 5,000,000 tons of the pure element magnesium, or in terms of carbonates, 69,000,000 tons of calcium carbonate equivalent, annually are being robbed from the Mississippi River drainage area and carried to the Gulf of Mexico. Of course, it is true that this does not all come from the top or tillable soil; some of it comes from the sub-soil and some from the underly-

ing beds of limestone. It is also true that the losses in the more humid regions east of the Mississippi must be greater than are the losses in the arid regions farther west. It has been estimated that the loss from Illinois soil alone is about 1,800,000 tons per year or about twice the amount that Illinois farmers are applying to their soil in the form of agricultural limestone and other liming materials; and yet Illinois is doing more in this line than any other state in the Union.

The Cornell Agricultural Experiment Station has conducted a ten-year research study which has led to the conclusion that there is an average drainage loss of calcium in New York amounting to 557 pounds per acre on bare soil; 345 pounds on land under a rotation in which legumes are a part and 363 pounds on grass land. Bear in mind this refers to the element calcium, not calcium carbonate nor magnesium carbonate. The loss in total carbonates would be relatively larger—approximately two and one-half times greater for calcium carbonate alone.

Bulletin No. 695 of the United States Geological Survey says that there are 6,000,000 square miles of tillable land in North America in which the total loss of all minerals, through solution, averages 79 tons per acre per annum; or the amazing total of 474,000,000 tons for the entire country. The average analysis while covering all mineral elements, shows the same to be mostly plant foods. The element calcium alone makes up 19.36% of the total and magnesium 4.87% thereof.

E. H. Worthen of Cornell has summarized these tremendous figures in a simple statement to the effect that the average loss in normal soil and under normal humid climate is 500 pounds of combined calcium and magnesium carbonates per acre, per year. In other words, it would take a ton application of agricultural limestone each four years on every tillable acre in the United States to offset the natural depletions that are taking place. Against this my own state, which uses more than any other, has applied limestone to about 15% only of its crop area.

Soil Depletion and Overproduction

How are we to reconcile the problem of this deplorable depletion of our soils with the equally deplorable problem of the overproduction of crops? Does it mean, as so many seem to think, that we should cease to use fertilizers and limestone and cease to grow legumes which increase the productive capacity per acre by restoring humus and nitrogen to the soil? To conclude that it does, it seems to me, would be to take a shallow or short-sighted view of the problem. The solution does not lie in reduced production per acre, but in reduced acreage. At this point I would like to quote, in summarized form, from the annual report of Secretary Hyde, of the Department of Agriculture, which report was issued last month, as follows:

After noting the reduced world demand for farm products, he emphasizes the importance of production adjustments as one factor in improving the relationship of the agricultural industry as a whole with its market opportunities.

In urging acreage adjustments, the Secretary declares that the answer to overproduction is less production. By this time it is evident, says the report, that supply and demand conditions cannot be set aside by legislation, that the dumping of surpluses abroad is not feasible, that the indefinite storing of surpluses tends to prevent, rather than to cause, a rise of prices, that tariff duties are not effective on commodities produced largely for export, and that subsidies would increase rather than restrain production.

Urging the voluntary curtailment of production, the Secretary says that the problem of readjustment varies with regions and with individual farms. This fact, he says, justifies a flexible adjustment policy, but not a refusal to make adjustments. He declares it does not follow, because some farmers can produce at a lower cost than others, that the low cost farmers should do nothing to prevent overproduction. Moreover, wise acreage adjustments, the report adds, can help to decrease the unit cost as well as the volume of production. This effect is produced by the elimination of the higher cost acres, and the concentration of the remaining production on the more productive land.

A Rational Land Utilization Policy Needed

Conditions emphasize, though they do not create, the need for a rational land utilization policy.

Such a policy, the report adds, calls for: (1) a scientific classification of our land resources, so that crop, pasture, and forest requirements may be met more efficiently, because knowledge of land resources is indispensable to the wise direction of production; (2) the necessary contraction of farm acreage in some areas, and an equally necessary check upon expansion in others; (3) steps by public agencies, local, state or Federal, to divert tax-delinquent lands or lands obviously submarginal for farming purposes to other than farm uses; (4) reconciliation of our national reclamation policy with the need for restricting farm production; (5) acceleration of public reforestation; (6) determination of a public-domain policy which shall serve equally the interests of the local farming and grazing industry, the interests of agriculture as a whole, and the interests of the Nation; (7) provision for information which shall guide private enterprise in land settlement.

There are two or three conclusions in Secretary Hyde's report which to my mind especially demand serious consideration. I refer to the checking of unwise expansion of crop areas through land reclamation projects, and the contraction of areas already under cultivation by restoring some of these areas to forests and some to grass lands, for which uses the Lord or-

iginally intended them. Some of the heaviest losses through erosion have been in areas that once were the finest grass lands on the continent but which have not proved especially successful as crop producing lands and which have been easily carried away by streams and rivers because they lacked sufficient organic binder.

Solution Lies in Reduction of Acreage

Much stress has been laid in recent years upon the importance of farmers, who are producing crops of which there is a surplus, resorting to so-called diversified farming. It seems to me that much of this talk has been superficial and ill-advised. Adaptable diversification is an efficient policy for the individual farmer, but the difficult plight of agriculture as a whole is not helped by chasing the surplus production from one crop to another or from one area to another. We will never get anywhere by playing tag with ourselves. Instead of lessening the total surplus problem by so doing, we are in danger of increasing the average unit cost of production for many of the crops by encouraging the growing of them in areas not well adapted thereto. As the Secretary has well said, the solution for over-production is reduced production and the burden of my talk today is that such reduction should be by acreage instead of in production per acre. If I am right in the statement that our grain surplus is about 15% and we could find a way, or adopt methods, under which 85% of the present average grain crops could be produced on about 75% of the present acreage, we would have completely reversed the picture. The unit cost of production would be reduced by the greater yield per acre and the market price per bushel would be increased by the elimination of the burdensome surplus.

How can this be accomplished? Admittedly much can be done by educational means and the advancement of organized cooperation among the farmers themselves but it is too much to expect that each farmer will voluntarily do his part in bringing about this reduction. So long as it is true that the individual who stays out of any such organized effort will receive his share of the benefit without making his share of sacrifice, the selfish incentive is for each individual to stay out instead of to cooperate. Either a way must be found for making it selfishly and directly attractive to each individual to do his part, or a way must be found for compelling him to do so, if the situation is to be adequately remedied by intelligent, constructive methods. Failing of such constructive results there is but one alternative, the cruel law of the survival of the fittest, will finally solve the problem for us by the destructive elimination of those individuals and acres which cannot longer compete. Legislative and government action should not be resorted to lightly, or in preference to voluntary action, but to the extent that the farming portion of our population is un-

able to achieve the necessary goal, through efforts at self-help, it is in the interest of the nation as a whole to lend assistance through government action. We are not lacking some precedent in this direction. Forest preserves have been established under which the owner agrees to leave the land idle in forest, and the government agrees that while so idle and unproductive of revenue return, the owner shall be relieved from taxation thereon. Why cannot the same principle be applied to cultivated land? When asked the question, "What shall we do with the surplus acres?" Alexander Legge replied, "The best answer I can give is to do nothing with them." I do not believe that Mr. Legge intended this to be taken too literally. I would like to supplement his statement by suggesting that the surplus acreage be laid idle so far as current revenue production is concerned but, instead of being allowed to deteriorate through the development of weeds and losses through leaching and erosion, that these surplus acres be "salted down", so to speak, in legumes (sweet clover, where climatic conditions make such possible, but at least some form of legumes adaptable to the local condition). Why cannot a selfish inducement be made through the abatement of taxes on all acres thus laid semi-fallow in self-perpetuating legumes? If abatement of taxes is not a sufficient inducement, why would we, as a nation, not be better off in the end, if we actually subsidized such acreage to the extent found necessary to accomplish the desired end? I estimate that an increase of 140% over the present acreage in legumes, in the grain belt of the United States, would solve the problem by reducing such grain acreage approximately 25% and by making it necessary for the remaining acres to be more productive per acre, in order to meet domestic demand. Land laid idle in legumes is improving in fertility and in physical condition and when it becomes its turn to go under the plow the yield per acre will be greater and the cost per bushel will be less. To the extent land might be returned to forest and to grass, the foregoing estimate would be reduced.

Agricultural Limestone Demand Should Be Increased

Of course, you have anticipated me at this point. An increase in legume acreage means an increase in agricultural limestone requirements and your industry should be and I feel is, tremendously interested in this problem for that reason. Here is where I wish to ask some well meant questions. What have you been doing about it? Isn't it true that too much of the money and thought of your industry, as a whole, has been spent on determining who shall get the available business, instead of how you can develop the aggregate demand? To what extent has your industry taken an active hand in legislative proposals and economic studies which bear upon this agricultural surplus problem? How much have you done as an organized industry in research work intended to make your ag-

ricultural limestone products better adapted to the purposes for which they are intended? Individual quarry operators have done much, but I refer to the industry as a whole. The real competition which the agricultural limestone producer has today is not some other limestone producer but is the producer of some other product which is making a stronger bid for the limited dollar of the farmer.

The maintenance of soil fertility (and agricultural limestone is but one factor therein) is becoming more complex every year. As I have already said, our soils are depleted not only in calcium and magnesium but in other plant foods as well. Scientific agricultural knowledge and the art of operative agriculture have been stepping forward rapidly. The laggard is finding the competitive going both fast and hard. The agricultural limestone producers can well afford to take their rightful place in the front rank of such progress.

I would like to touch upon matters pertaining to classification and grading of agricultural limestone both chemically and physically and also upon some of the problems of production, distribution and use, but I am afraid time will not permit. I must, therefore, be content with pointing out that some of our supplies of agricultural limestone are in nature a by-product of the crushed stone industry; that in some localities they are a co-product with other sizes of stone, under which classification the operator adjusts his crushing, pulverizing and screening scheme so as to balance the various sizes, including agricultural limestone, with commercial demand. In other cases the product is a direct product, being independently pulverized or milled from carefully selected raw stone. This three-sided character of material, so far as sources are concerned, is likely to continue but in determining what size and grade of material a producer should market or a consumer should use, it is necessary to consider the purpose for which it is to be used and the need which it is intended to satisfy. The use for limestone, agriculturally speaking, is not limited to one consideration. Its great value lies in the fact that it accomplishes many desired ends.

Too Much Emphasis On Neutralization

Too much emphasis, relatively, has been placed upon the neutralization of soil acids. Perhaps soil acidity is as much a symptom as it is a disease. In addition to neutralizing soil acids, lime in the soil promotes the development of useful and necessary bacterial life, including the bacteria which are capable of capturing atmospheric nitrogen and converting it to available nitrates. Limestone supplies directly calcium and magnesium which are essential plant foods. Limestone improves the physical character of soil, flocculating or making lighter the pasty clay soils and giving body and binder to the loose or sandy soils. Whether agricultural limestone for a given field should be high

(Continued on page 25)

Expansion and Contraction of Concrete

By A. T. GOLDBECK

Director, Bureau of Engineering,
National Crushed Stone Association

IT has become the habit to think of quality of concrete in terms of its compressive strength. There are many other qualities, however, which are equally important. In certain types of structures, the expansion and contraction changes in concrete are of the utmost importance and these qualities must be given consideration in concrete highway design. It appears that certain types of concretes expand and contract more than others. Concrete changes in volume due to temperature change and also to change in its moisture content. For illustration, when moisture dries out of concrete, shrinkage takes place just as in the case of decrease of temperature. When moisture is absorbed by the concrete it swells. All concretes are not affected in like manner due to the absorption of moisture and there are a number of different factors which control the amount of the swelling or shrinking. One of these is the richness of the mix and still another is the age of the concrete. In practice there seems to be some indication that the type of aggregate might have some effect on the shrinkage of concrete and it was to investigate this phase of the subject that the present investigations were undertaken.

It has been the observation of the writer that certain types of aggregates are particularly harmful in causing high volume change. For illustration, light slags have seemed to cause excessive expansion in the presence of excess moisture and the result of this action is to cause the blowing up of concrete bases and pavements where such aggregate has been used. This action does not always take place but there are enough cases of this kind to warrant its investigation. Laboratory investigations were, therefore, made on slag concrete containing a wide range in weight of slag and on other concrete.

The specimens used for this purpose were the broken ends of concrete beams 6 in. by 6 in. in cross-section and the gage length was 10 inches. The concrete was mixed in the proportions of 1:2:3 by dry, rodded volume and it was cured for 28 days in the moist room. After breaking off one end of each concrete beam which was originally 36 inches long, the remaining portion was placed back in the moist room for a period of two months longer when the beams were again broken. These ends, broken off at 28 days were stored in the air and finally the expansion and contraction measurements were undertaken at an age of approximately eight months.

For the purpose of taking expansion measurements, brass plugs were set on each side of each specimen at a gage length of 10 inches and holes were drilled in

◆ Concrete expands and contracts under different climatic conditions. This phenomenon is one of the utmost importance in the design of concrete highways. These volume changes are due to change in moisture content and to change in temperature. The type of aggregate is an important consideration and the following article gives the results obtained from volume change experiments when different types of aggregates were used.

these plugs with a No. 56 drill. The Whittemore strain gage was used in making the measurements. This gage reads with an accuracy of .0001 of an inch. To correct for temperature errors in the instrument, a gage bar immersed in ice water was read at frequent intervals and temperature readings were also taken on the specimens. All of the specimens were in an air dried condition before beginning the test and they were then immersed in water and readings were taken at frequent intervals, especially during the early period of the test.

Limestone concrete specimens made in exactly the same manner and at the same time as the slag concrete were also tested for their change in volume. For the sake of convenience the slags have been grouped into what might be termed a "light" group, a "medium" group and a "heavy" group. The light group includes slags of 70 lbs. in weight and under; the medium group from 70 to 80 lbs. and the heavy group above 80 lbs. in weight.

As will be seen in Fig. 1, light slags show the highest expansion and two of the samples, Nos. 15 and 7, respectively, the slags weighing only 59.7 and 57.8 lbs., respectively, showed the highest expansion of all. There was practically no difference in the expansion between the limestone concrete and the concrete made with the heaviest slag. The maximum expansion of the medium weight slags during the period of immersion which extended up to 145 days was approximately .00035 inches per inch of length and the limestone concrete at the same period showed an expansion of .00027 inches per inch of length. Apparently, then, the medium weight slags have about 30 per cent higher expansion due to moisture than this particular limestone concrete. The very lightest slag had a maximum expansion at 145 days of .00049 inches per inch of length which is .00022 inches, or approximately 81 per cent greater expansion than in the limestone concrete. Two of the light slags, however, showed just about the same expansion as the limestone concrete and still two other light slags were higher in expansion than the limestone.

It seems to be indicated, however, that the very lightest particles of slag have an influence in increasing the

expansion of the slag concrete and perhaps even though the average weight of slag may be classed as medium, if it has a high percentage of the light particles and a high percentage of heavy particles, the light particles might cause undue expansion.

At the end of 45 days all of the specimens were subjected to freezing to determine what effect this might have and, finally, after the freezing process the specimens were all allowed to dry in the air. As seen by the drop in the curves, all of the specimens immediately showed shrinkage. Shrinkage of the limestone concrete seemed to be more rapid than that of most of the slags, possibly due to the retention of water by the porous slags.

Most of the blow-ups occur in concrete roads during the Spring of the year when there is the combined expanding effect of moisture in the concrete and high temperature. Later on in the Summer as the moisture is evaporated, notwithstanding the possibly higher temperatures which exist, many of these blow-ups recede and the road settles back into place in many cases. Because of the combined effect of moisture and temperature in expanding concrete, it was felt advisable to study this phenomenon as it may be affected by the characteristics of the coarse aggregates. For this

purpose the specimens were first measured when they were at a temperature of approximately 80°F., this temperature being maintained by immersing them in water. The water temperature was then gradually raised until it reached a temperature of 120°F., and the specimens were kept in the water at this temperature until they were uniformly heated. Again, strain gage readings were taken to determine the amount of the expansion and the results from these specimens are shown in Fig. 2. It will be noted that the curves for the various weights of slag and also for the limestone concrete seem to have approximately the same slope, indicating that the coefficient of thermal expansion is about the same in all cases, irrespective of the characteristics of the coarse aggregates. To carry this study further the specimens were frozen solidly during a period of 24 hours and measurements were taken on the frozen specimens. These measurements are shown on the left portion of the curve in Fig. 2. The slopes of these curves give a measure of the coefficient of expansion per degree Fahrenheit, and the average coefficient for all of the specimens was approximately .0000048 inches per degree Fahrenheit.

No conclusions are warranted as the result of these investigations although there is a very strong indica-

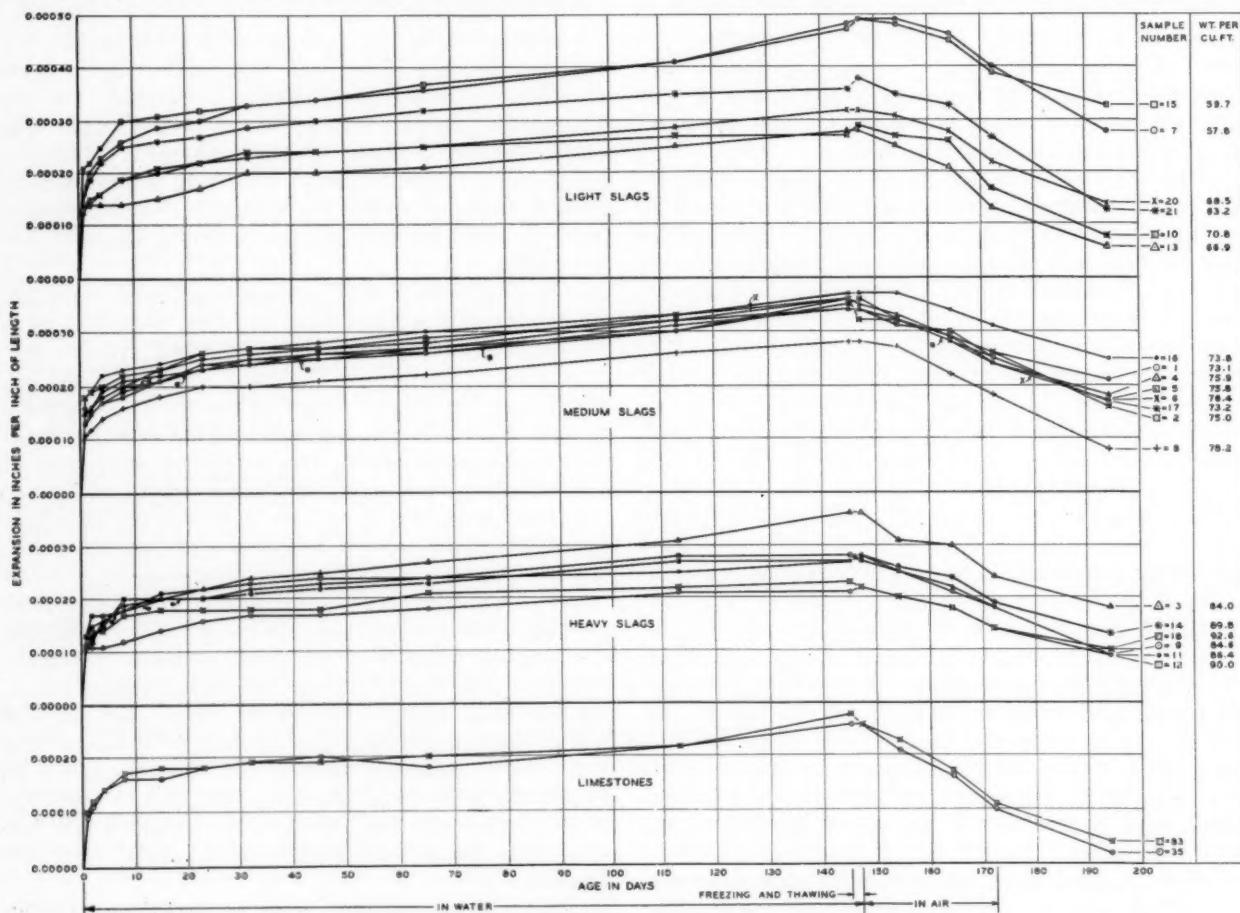


Fig. 1—Expansion and contraction of concrete due to moisture changes

tion that concrete made with light slag expands more than concrete made with heavy slag or with limestone coarse aggregate. One important fact to notice is that frozen concrete shows no expansion due to the expand-

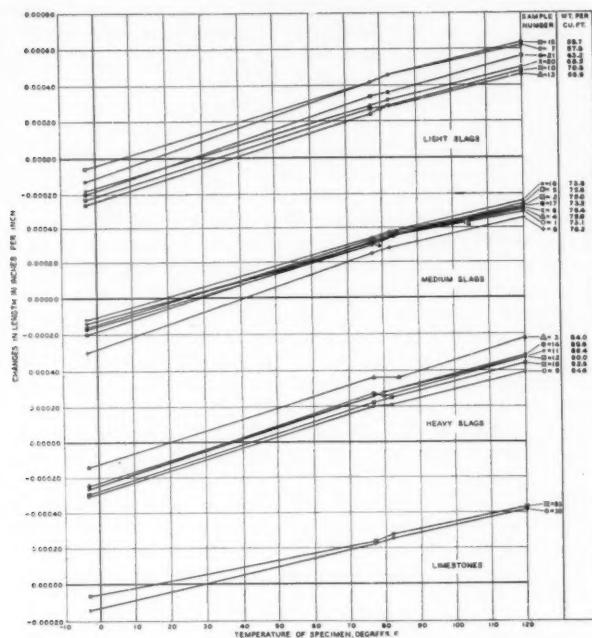


Fig. 2—Changes in length of concrete due to temperature change

ing force of the ice within the pores. On the contrary, normal contraction does not seem to have been altered by the freezing. These expansion measurements should be useful in connection with the design of concrete structures, particularly as regards the spacing and thickness of expansion joints.

Meeting of the Joint Committee on Concrete and Reinforced Concrete

THE Joint Committee on Specifications for Concrete and Reinforced Concrete met in the rooms of the Western Society of Engineers, Chicago, on February 27 and 28. This Committee, which is made up of five representatives each of the American Society of Civil Engineers, American Society for Testing Materials, American Railway Engineering Association, Portland Cement Association, and the American Concrete Institute, is a reorganization of the Committee that made reports on concrete specifications in 1921 and 1924.

A number of developments since the 1924 report makes certain changes in the specification desirable. Among the advances which have been made, relating to concrete as a material in recent years, the most significant are the developments in cement, use of ready-mixed concrete, and a more widespread understanding of the design of mixtures with increasing attention to field control.

In the field of design, an outstanding development

which should be covered in future reports of the Committee is the tendency towards the greater use of rigid frame construction.

All these developments are to be given consideration by the reorganized Committee in addition to a general study of the 1924 report with a view to improving its presentation and widening its scope.

The Committee proposes in its report to separate portions which are in the nature of specifications and those which are in the nature of recommended practice. It is planned also to add as an appendix the technical data upon which the recommendations of the report are based. The Committee is considering the necessity of distinguishing between the requirements for so-called outdoor concrete and concrete in locations such as heated buildings not exposed to the effect of weather. Watertightness as an element of durability will be recognized as one of the essentials of concrete for outdoor exposure. The necessity for this has been brought about by the recent development of generally higher strengths in portland cements. Following the practice which has become quite general of designing concrete for a given strength requirement, it is possible with these newer cements that mixtures will result which are too lean for proper durability. Some limitation will, therefore, be placed upon the cement content to avoid this difficulty.

In the field of design of reinforced concrete, the Committee proposes to present the recommendations in regard to moment coefficients by putting primary emphasis on the general case of unequal spans, thus reversing the arrangement in the 1924 report in which the emphasis is placed on a series of equal spans. Moment coefficients will be given only for the case of equal spans and these will be presented with separate coefficients for live and dead load.

The next meeting of the Committee has been set for June 22 and 23 in Chicago.

Government Statistics of the Cement Industry For the Month of February

American Portland cement mills still show a decline in the ratio of operations to capacity as indicated by the figures for the twelve months' period ending February 28. According to statistics released recently by the Bureau of Mines of the Department of Commerce, the ratio of operations to capacity for the last twelve months was 59.7 per cent. The ratio percentage for the twelve months ending February 28, 1930, was 65.6 per cent, and for the twelve months ending February 28, 1929, was 71.0 per cent.

During the month 5,920,000 barrels were produced, 5,048,000 barrels were shipped, and stocks on hand at the end of the month were 28,478,000. Production in February, 1931, was 27.5 per cent less and shipments 28.0 per cent less than in February, 1930. Stocks at the mills were 0.8 per cent more than a year ago.

Notes of Interest to Aggregate Producers

IN THE JANUARY, 1931, issue of the Journal of the American Concrete Institute¹ there is published a report by Committee No. 101 of which Mr. H. F. Geronman of the Portland Cement Association is Chairman. This Committee makes an annual survey of the current research and the present report contains many items of interest to aggregates producers. Some of these items are published herewith as they occur in the above mentioned report.

Effect of Mixing Coarse Screenings with Sand which does not Meet Specifications: (Kentucky State Highway Department and University of Kentucky, Lexington.) This procedure has been in operation for two years, with excellent results. A complete report on the findings from this study will be published soon.

Durability of Concrete Made from Unsound Stone: (Kentucky State Highway Department and University of Kentucky, Lexington.) This investigation included tests on concrete made with 50 and 100 per cent unsound fine coarse aggregate. Concrete made with 100 per cent unsound aggregate and exposed to weather tested as follows: 3 per cent increase in strength from 28 days to 6 months, with no failures due to disintegration; 11 per cent decrease in strength from 6 months to 1 year, one specimen in three having failed through disintegration; 44 per cent increase in strength from 1 year to 2 years, with two failures due to disintegration.

Concrete made with only 50 per cent unsound aggregate tested as follows: 36 per cent increase in strength from 28 days to 6 months; 13 per cent increase from 6 months to 1 year; 27 per cent increase from 1 to 2 years. In this group of tests there was some crazing but no disintegration. Tests will be made through the 5-year period.

Well-Graded Washed Sand Versus Crushed Granite Screenings as Fine Aggregate: (University of Colorado, Boulder.) For the conditions of these tests the granite screenings gave concretes which were decidedly above those from the washed sand in strength and fully equal to them in workability. These tests were with identical coarse aggregates and water-cement ratios. Mixtures of sand and screenings gave strengths below those for the screenings alone but above those for the washed sand.

Limestone and Gravel Used as Coarse Aggregate: (Pennsylvania Department of Highways, Harrisburg.) Tests were made to compare the relationship between strength of concrete in which limestone and gravel were used as coarse aggregate. Modulus of rupture tests were made on concrete beams and compression tests on concrete cylinders at ages of 1 day to 1 year. At all ages the crushed limestone gave higher strengths than the gravel. The modulus of rupture of the limestone concrete at various ages ranged from 10 to 20 per cent higher than that of the gravel concrete. In compression, the limestone concrete was between 20 and 35 per cent higher than the gravel concrete.

Use of Soft Limestone in Concrete: (Iowa State Highway Commission, Ames.) Tests were made to determine the effect on strength and durability of concrete of the use of relatively soft limestone as coarse aggregate. Six by 6 by 30 in. beams and 6 by 12 in. cylinders were made using normal limestone in one group, and a very soft limestone in companion specimens. Strength tests indicate a slight decrease in both flexural and compressive strengths, particularly for soft limestone which was found to be unsound in the sodium sulfate soundness test.

♦ Abstracted from the Report of Committee No. 101 of the American Concrete Institute on "Current Researches on Plain and Reinforced Concrete and Related Materials."

Study of Relation Between Coarse Aggregate Content and Quality of Pavement Concrete: (U. S. Bureau of Public Roads, Washington.) The object of this investigation was to determine the effect of variations in the amount of coarse aggregate on workability and quality of Portland cement concrete in pavement slabs constructed with standard equipment. The study involves the construction of approximately one-half mile of concrete pavement 9 ft. wide and 7 in. thick, constructed in 9-ft. sections. Both crushed stone and gravel were used as coarse aggregate and the proportions varied from a distinctly over-sanded mix (1:2:3½) to mixes containing as high as 4% parts of crushed stone and 5½ parts of gravel. Observations were made on the relative workability of the various concretes when finished with both of the standard finishing machines now on the market. The quality of the concrete was determined by flexural tests on concrete beams 27 in. wide and 5 ft. long taken from the test sections. Other tests for quality, such as compression tests on cores drilled from the slabs, and freezing and thawing tests of concrete specimens taken from the beams, were also made.

Effect of Crusher Dust on the Strength and Other Properties of Mortars and Concretes Made from Crushed Granite: (University of Colorado, Boulder.) Crusher dust (of the same material as the aggregates 0-100 grading) was added to mortars and concretes as a check on the extent to which accidental concentrations of dust might be harmful to the quality of the concrete. At a constant water-cement ratio the dust strengthened the concrete but stiffened it materially. At constant slump the increase in strength from adding dust was about equal to the decrease from increasing the water-cement ratio up to an amount of dust equal to 15 or 20 per cent of the total fine aggregate. The conclusion from these tests and materials is that no ordinary concentration should be injurious but it may complicate the control of mixing water and workability. The results from these tests should not be extended to other conditions and materials without experimental verification, however.

Relationship Between Cement Factor and Wear and Strength of Concrete: (Kentucky State Highway Department and University of Kentucky, Lexington.) The purpose of this investigation was to establish an economical cement factor as a basis of control for pavement concrete. A concrete mix was used in which the fine aggregate was 1.2 times the voids in the coarse aggregate, with a cement factor varying from 1.5 to 1.7 bbl. per cu. yd. Comparisons were made of different aggregates in beams, cylinders, and 9-in. balls. Below is a summary of the tests made using stone and gravel:

Cement bbl. per cu. yd.	Coarse Aggre- gate	Water- Cement Ratio	Wear Concrete Balls %	Strength 28-Day		Strength Compressive Specimen at 42 Days	
				Com- pressive	Trans- verse	Cylinders	Cores
1.5	Stone	0.74	19.4	3600	860	5061	4888
	Gravel	0.70	19.4	3200	643	3732	3300
1.6	Stone	0.70	17.5	3273	817	4465	4000
	Gravel	0.63	15.9	3800	712	3856	4300
1.7	Stone	0.68	15.0	4581	912	4521	4725
	Gravel	0.60	11.7	3585	692	3990	3990

¹ Published by the American Concrete Institute, 2970 West Grand Blvd., Detroit, Michigan.

(Continued on page 22)

America—A Going Concern¹

By MERLE THORPE
Editor, Nation's Business

SO far have we gone in our national progress that cautious souls are saying we have travelled too fast, that we have thought up new ways of making things faster than we have contrived means for people to use them and pay for them.

Well, there's one surplus no one would miss. No one who has eyes to see or ears to hear will doubt that 1930 produced a new all-time record output of pessimism. You could get a free load of it anywhere without asking. But we are entering, let us hope, the final stage of our folly. The air is charged with rumors. The whispering campaign is on. No business is immune.

Have you heard about such and such a bank? Do you know old So-and-So is going to the wall? I heard the Doe Company is headed for receivership. The Roe Company has passed its dividend.

Only by wearing ear muffs can one walk a block without having his confidence shaken.

Of comfort let no man speak;

Let's talk of graves, of worms and epitaphs.

Depression is the most widely advertised product of our times. Headlines, headlines everywhere and no one stops to think.

And our vaunted salesmanship! Give a salesman time enough and he'll paint so drab a picture of the future that a likely prospect will replace his fountain pen—and lock the safe.

Of unemployment, I suspect there are more idle tongues than idle hands.

The folly of too many of us is to accept the echo of the locker room and club as the Voice of America.

It is my deliberate judgment that we have lost our perspectives rather than our prosperity. The trouble is that too many of us live only in the present. We mistake our corner of the world for the universe itself. Every fault of our times looks like a permanent handicap to progress.

Now, loss of perspective is a very serious business.

It leaves a man helpless, takes away his sense of value, puts him in a way of fatty degeneration of the will—and eventually writes him off as a total loss.

You probably read in the papers recently of a Congressional Hearing at which Mr. Owen D. Young used the words, "In prosperous times like these." It gave you a shock. It did me. But Mr. Young, like so many other successful executives, doesn't take the worm's eye view. He thinks in years where most of us think in days and weeks. He probably recalled that year of depression in this country when hogs sold at a dollar a head, and corn at eight cents a bushel. And another

♦ In his characteristically entertaining manner, Mr. Thorpe reaffirms his belief in America as a going concern. With so much comment these days of a pessimistic nature, it is pleasing to hear from one whose faith remains unshaken.

time when your bank would not cash your check for over \$10 and even state warrants were selling at a discount.

It is a heartening sign, I believe, that more and more people are beginning to realize that they need their perspectives. Some day I expect to see an advertisement something like this:

Lost—Somewhere in 1930 a first class, slightly used perspective. Finder return to any blind American business man. Liberal reward and no questions asked.

As soon as his vision is recovered, he will observe that the American people did not shut up shop in 1930. They did things. They went places. They made hay in a time of drought. The figures on national income tell the story. The index of general production and trade in the United States in 1930, as computed by the Federal Reserve Bank, points to a national income of approximately \$75,000,000,000.

But I hear you ask, "How does that stand up with 1929?" According to Walter R. Ingalls, a recognized authority, the national income in 1929 amounted to \$83,429,000,000. And 1928? \$79,000,000,000—and if we look back at 1922, only a short time ago, the total was \$60,685,000,000. So 1930 was exactly 25% better than 1922.

And mark this, the \$75,000,000,000 so far credited to us in 1930 is more than the income of all the European nations combined, though Europe has four times the population of the United States.

A nation that could make such wholesome showing has no business in the Pessimists' Club, as in fact a pessimist has no business in business. We have heard too much from the false prophets and too little about the real profits of 1930. Too many of us are too ready to admit there was "no business" in 1930. May I repeat to you again some of the credit entries in our national ledger last year?

Consider the lowly freight car—46,200,000 loaded and unloaded last year. And with 3,518,000 trucks on the job, too.

One family in ten bought a new automobile, representing an expenditure of \$2,159,600,000 for new cars. Registrations highest of any year, and 399,000,000 barrels of gasoline consumed, the greatest in history.

The production of electricity hit a high mark for all time. 1930 produced 41 million tons of steel—700 pounds for each man, woman and child. It manufactured four and a half billion yards of textiles and 315

¹ Transcript of the thirteenth radio talk of the "How's Business?" series, conducted by Merle Thorpe, Editor of Nation's Business.

million pairs of shoes—the usual two and a half pairs to the person.

No business?

1930 provided a payroll for forty-odd million men of at least forty billions, and dividends of \$4,500,000,000.

1930 saw to it that expenses of living did not exceed income, as evidenced by hundreds of millions of dollars increase in savings bank deposits and eighteen and a half billions of new life insurance.

1930 furnished a market place where goods, services and labor were exchanged to the extent of 100 billion dollars, and the returns are not all in yet.

No business?

Too many, in answering the question: "How's Business?" take the worm's eye view.

A more important question just now is: Did you get your share of this impressive total? And if not, why not? Consider the answer carefully. Face facts. Be honest with yourself. For the answer to this question may determine the share of business you will get in 1931. The business will be there, never doubt—lots of it. They will get their share who pay the price of intelligent planning and tireless execution. The flabby-willed and the sluggards will fall aside to make way for the able fighters coming up from nowhere and everywhere.

It is the law. "What will ye have? Pay for it and take it," written 4,000 years ago, is as true today as then. And as we personally and individually accept that truth and go out and make business activity, will the answer be furnished to "How's Business?" in 1931.

Sweet are the uses of adversity—and of depressions. In this dynamic ferment, this churning process, of the commercial order the usefulness is there, if not apparent. Let me quote on this point Mr. C. A. Stone, Chairman of the Board of Stone & Webster, public utility engineers, managers and financiers. He sees in the present depression a tremendous opportunity for the young men and the older men with young hearts and heads—that never would be theirs otherwise.

"The adversity of today," says Mr. Stone, "shuffles the cards anew and gives the young privates in the business ranks chances according to their talents and characters, that they would never have had in a dead level of continuous prosperity."

One thing sure, this is not a world of automatic progress. Our only real excuse for being here is that our strength may in some way help to force the cause of better things to victory. It is human to grumble and complain, I know. But, for myself, I am not ready to acknowledge that our people *enjoy* poor health, as the old lady said, either in their physical or in their economic natures. I believe that the faith and the fortitude of the pioneer are still active assets. I believe we have an enduring hospitality for the new, the untried, the unknown, and that our national spirit demands the thrill that comes from breaking new

trails, from plowing virgin soil, from raising roofs in a roofless world. It is one of our most decisive characteristics that we relish a fight against odds.

Our history is no pale chronicle of conquest on the calm level of the commonplace. Rather it is a treasury of devoted exploit and sacrificial idealism. Had our forbears never pushed their fate beyond the visible assurance of security, there would be no Washington, no Lincoln, no Declaration of Independence, no Emancipation Proclamation, no community of interest that we know as the United States of America.

Yet it is unhappily true that the counsel of "do nothing" and "play safe" is no curiosity in our land. We are told that any deviation from the flat plane of progress is bad for the national heart, that a polite simmer of enthusiasm is a sufficient sign of life.

You may remember that when the men who followed Garibaldi asked him what their reward would be, they were answered: "Hunger and thirst, forward marches, battles, and death."

Garibaldi and his devoted Thousand ventured bravely—and freed Italy. "Forward marches." There is the keynote of all progress. The will to go ahead, and to keep on going, come what may. The resolution to face hardship, to sacrifice, to win. It is this spirit of adventurous courage which has raised individuals, institutions, and nations to fame and power. Let it lapse, and decadence and dependence begin.

I wonder whether England's precarious industrial situation is not largely explainable through the mental attitude defined by the headmaster of Darlington Grammar School. I give you his judgment in his own words:

"The spirit of adventure is, perhaps, rather on the decline. It may be that the opportunities through which many of our great men have risen from small beginnings are no longer possible, but there is certainly not so much readiness to start at the bottom and make the heavy sacrifices in order to reach the top."

That state of mind did not build the British Empire, nor does it give a man or a nation success of any sort.

Rather let me quote Gordon Selfridge, head of a great mercantile house—Selfridge & Company of London, an American as you may know. He has not lost his American spirit when he says:

"This business, at least, always plays hard for a win. It is beneath our ambition and our ideal to play for a draw. We believe this higher and harder purpose to be essential to the welfare of this business, but we believe it to be essential to the welfare of the country's business as a whole."

What does that mean—"essential to the welfare of the country's business as a whole?"

It means that activity is infectious. That no matter where, in big city and small town, wherever business is done, one man of boldness, who conceives an idea and then goes forward to put it into operation makes opportunity for dozens, scores, hundreds, and thou-

sands of other men. He ignores the wise-heads who say, "It has never been done before," and "the risk is too great." The men who clearly foresaw the future of radio made a great opportunity for themselves, but what thousands of men have discovered in it other opportunities for themselves. So with the man who directs a large business. He gets the idea, he carries it out, and as he carries it out he makes opportunities for hundreds, perhaps thousands, inside and outside his own business. But inside the business the same multiplying process is at work. One member of the business, going boldly into new paths, makes openings for many of his fellow workers, so that there comes a time when even the least aggressive finds himself provided with opportunities.

And it is just as clear that if time and change revise individual fortunes, the articles of our national faith are enduringly solid and secure. No business man worthy of the designation doubts that the sun will rise on schedule, or that the seasons will play their regular engagements on the American circuit. Not even the most professional pessimist has yet hinted that our shore line is shrinking, or that our land area is disappearing. True, forests have gone, but new trees are planted in the persistent belief that they will grow.

Our great rivers have not dried up, nor have our mountain ranges collapsed. Winds blow from all directions, and Nature turns on her heat and cold with characteristic disregard of forecasts and forecasters and the Weather Bureau.

The inescapable conclusion is that this familiar America of ours is a going concern.

One would think, from the wailing, that we had all been wiped out by a terrible catastrophe of Nature—a Noah's flood, a shifting of the Gulf Stream, or by a dreadful holocaust.

Yet we are all here. The stores are still open. The trains are running. You can get that number on the telephone. The traffic problem is still lively. Movie houses are no nearer seating all their customers. Children are what they always were. Young folks are getting married. Preachers thunder against the laxity of the age. Amos 'n' Andy are still in the taxicab business, or were an hour ago. Doctors and dentists make appointments weeks ahead. Lawyers' briefs are just as long. Hardy commuters make the 8:15 in less than nothing flat. And under Nature's white coverlet, bud and blossom await the sure coming of spring.

My friends, the only people who are dubious about the future of American business are the ones who do not understand the American spirit. The manifestations of that spirit are as broad as the land, and as various as our citizens. And no manifestation is more pertinent to the present situation, I think, than the laconic text which appeared years ago in the window of a bank in the flood stricken city of Hamilton, Ohio. That placard read:

"Noah was six hundred years old before he learned to build the ark. Don't lose your grip."

Public Projects Require Workmen in Great Numbers

By E. E. DUFFY

DANGER—Men at Work," will be a sign of the times when public improvement projects get under way in the early Spring. Although many state, city and local governments have not only planned but awarded contracts for 1931 construction, numberless communities have needed projects still hanging fire.

That public construction provides work for vast numbers is not merely a rumor is attested to by a recent report of the Conference of Pennsylvania Construction Industries. Of the \$64,000,000 spent on highway and bridge construction in Pennsylvania last year, the Conference calculates that approximately 80 per cent, all things considered, went into the pockets of workmen. Labor's share was \$51,200,000. As many as 22,530 men were employed by the State Highway Department and contractors, and considering laborers provided work indirectly, some 30,000 men were necessary for the 1930 highway program.

Emphasis is placed on the need for highway construction by the fact that when 1930 road construction ended with the coming of winter there was a sharp ascent in the unemployment curve in Pennsylvania.

Minnesota is considering a highway bond issue for \$15,414,000. Its importance is realized when it is learned that of this, \$9,248,000 would go to labor over a two-year period, which according to Jay T. Ellison, chief engineer of the Minnesota State Highway Department, would mean jobs for more than 5,000 men for two years.

Illinois, a state that has already won all-time honors in road building, will this year embark on her greatest construction program. Some \$45,000,000 will be spent; some 50,000 men employed.

Chicago is building what is known as Goose Island viaduct. It is to be a half mile long and will include two bascule bridges. Three hundred men are starting the job; as many as 4,000 men will be employed later for the greater part of 18 months.

The above mentioned activities are large, but the same theme runs through the small project as the large—public construction requires men and lots of them.

Hanover Quarry Establishes Two-Year Safety Record

WITH the close of the year 1930 the Hanover Quarry of the Bethlehem Steel Corporation completed two years with no lost-time accidents, having worked during that time a total of 476,424 man-hours. The establishment of this meritorious record places the Bethlehem Steel Corporation in the fore-ranks of the members of the National Crushed Stone Association who have been particularly successful in the field

of accident prevention. Those members of the Association who at the close of 1929 (the last year for which records are available) had established records of two successive years or more with no lost-time accidents include the Speed Quarry of the Louisville Cement Company with a total of five years with 815,259 man-hours of exposure, the Cape Girardeau plant of the Marquette Cement Mfg. Co. having a total of two years with 410,248 man-hours of exposure, and the Birdsboro trap rock quarry of the John T. Dyer Quarry Company having completed two years with a total exposure of 333,644 man-hours.

"The record at Hanover indicates the value of intensive safety effort, even with small operations," says M. L. Jacobs, Manager of Quarries for Bethlehem. "The operation at Hanover is a limited one, with about one hundred persons employed, but the accident situation always comes down to the personal equation and the care of one worker or one hundred workers is just as important as the care of ten thousand."

"Our accomplishment during the past two years may be credited to the excellent safety program handled by our employees who have their first aid teams, competitions and first aid work, and very thorough training in accident prevention activity."

The accident prevention program was developed at Hanover with the cooperation of Thomas J. Quigley, Chief, Mines and Quarries Section, Department of Labor and Industry, State of Pennsylvania, in collaboration with J. E. Culliney, Manager of Safety for Bethlehem and C. R. Orndorff, Superintendent of the Hanover Quarry.

Pennsylvania Producers Elect F. O. Earnshaw President

At the annual meeting of the Pennsylvania Stone Producers Association held at the Penn-Harris Hotel, Harrisburg, Pennsylvania, on Friday, March 13, F. O. Earnshaw of the Carbon Limestone Co. was unanimously elected as President for the ensuing year. The Secretary was also instructed to cast a unanimous ballot for the election of S. W. Stauffer, J. E. Baker Company as Vice-President and P. B. Reinhold, Reinhold and Company, Inc. as Secretary and Treasurer. Immediately following the election the new officers were inducted into office.

Mr. Jacobs, Chairman of the Specifications Committee, reported that after careful consideration of the specifications by both the Department of Highways and the Association's Specifications Committee a new size, namely, No. 5-A Ballast was added to the present list of sizes. The new size has been approved by the Pennsylvania Department of Highways and will be used during 1931 on the low-cost type of water bound macadam highways.

It was moved by Mr. Jacobs, seconded and unanimously carried that an expression of appreciation be

placed on the minutes of the Association for the work which has been done and service rendered during the past several years by the officers, Messrs. Gucker, Earnshaw and Reinhold.

Mr. Jacobs, as Chairman of the Surety Bond Committee, reported that a meeting had been held of all of the interested aggregate and material producers at which time the question of surety bonds was thoroughly discussed. He stated that a surety bond bill has been prepared and already submitted to both houses of the legislature for definite action. Mr. H. H. Wilson, a member of the Association, and Chairman of the Pennsylvania Constructors Association, in an interesting address made clear many important elements in the bond situation wherein the material producers and contractors are mutually affected.

It was suggested by Mr. Wilson that the Association give serious consideration to the credit bureau system of regulating credit relations with particular regard to the system at present being used by the Credit Bureau in Detroit. The President will appoint a committee to study this matter.

Mr. Andrews came to the meeting direct from Washington where he had been in attendance at a meeting of the Executive Committee of the National Crushed Stone Association. He reviewed briefly Mr. Goldbeck's proposed plan for enlarging the scope of the Association's research work and emphasized the importance of the Pennsylvania producers' giving additional financial assistance to the fund which is being raised for the purpose of expanding the National Association's research activities.

President Earnshaw read Mr. Jacobs' letter of January 21, 1931, regarding the advisability of having Governor Pinchot reestablish the safety work of the Quarry Section and bring it under the Bureau of Mines. The President appointed as a committee to investigate this question, Messrs. Jacobs, Duff and Sheffer.

Mr. Andrews, as Chairman of the Uniform Sales-Contract Committee, reported that the work of his committee had been completed and that a form of contract had been submitted and accepted by the Association as incorporating all of the essential elements affecting sales and shipments. It was decided to have 5,000 copies of the contract printed at Association expense and that at least one hundred copies should be sent to each of the members.

Because of unforeseen changes in his plans the Hon. S. S. Lewis, Secretary of Highways, who had been invited to be present at the luncheon, was unable to attend. The President appointed Messrs. Stauffer, Sheffer, Jacobs, Andrews and Reinhold as a committee to call upon Mr. Lewis in the afternoon. The committee was deeply impressed with the familiarity of Mr. Lewis with highway matters and was encouraged to learn that the State will engage in as large a highway program as funds will permit.

Popularizing An Industry¹

By ROBERT J. KRATKY
Attorney-at-Law, St. Louis, Mo.



I REALLY esteem it a rare privilege to address you, the elite of the crushed stone industry. It is one thing to produce crushed stone. It is a huge task, requiring the highest degree of skill. But it is quite another thing to sell it. Successful salesmen are, and indeed should be, in a class by themselves.

For nearly twenty years, I have been a practising lawyer, specializing in organization work, industrial, civic and political. I am unable to discuss the technical side of crushed stone production or sales. However, since I have dealt with the crowd to earn my living during half of my life, and since you in the final analysis, must also deal with the public for your own sustenance, perhaps you will have a minimum of difficulty in understanding my language. At least, that is my hope.

If there has been a definite movement in the crushed stone industry to popularize it, I am not aware of it. Inquiry developed this fact: For years, the industry has striven to improve itself. By means of trade papers and otherwise, it has made splendid progress along educational lines, inside its own ranks and among the users of its commodity. By "users" I mean contractors, engineers, architects and public officials generally—those people who purchase your product initially either for their own use or for the use of others. The achievement of the industry in this direction is most laudable. It is one in which the industry can take a great deal of pride. By all means, this endeavor should be encouraged and enthusiastically continued.

In my opinion, even if you had reached perfection in the field in which you have so earnestly worked, your task would be but half done. I am thinking of the great mass of people, whose idea of the stone industry consists of a quarry with water in it, wherein a lot of intrepid little boys swim all of the time and some of them sometimes drown. What has been done to educate them? What has been done to acquaint them with the utility of stone? What has been done to cultivate in them a taste for stone? What has been done to so fix stone in the consciousness of the people that it will have a place to be reckoned with in their future plans?

General Public Is Ultimate Consumer

Some one asks: Why should the public generally be made familiar with our industry? My answer is:

♦ In which Mr. Kratky offers some interesting comments from the viewpoint of one not engaged in the crushed stone industry.

Because the public generally is the ultimate consumer. On the broad theory that the people ultimately get what they want, an educational campaign among them will create a demand supplementary to that already created among the users of stone. Need I remind you that crushed stone could be used in many instances where competing aggregates are being used today?

Too many industries, in my judgment, have lamentably failed to anticipate the needs of the people. They have not intelligently tried to direct the thoughts or the desires of their possible consumers. For instance, in our scheme of things, everybody is a potential home-maker. The large number of present bachelors and bachelor maids to the contrary notwithstanding, it may be safely presumed that the average person will marry. He will want a home. He will want to be a home owner. If the only opportunity to sell him on the advantages of stone is presented when he goes to the architect to design his home, that is better than none at all. But why wait until then? The architect may favor some other material. He may not afford such a chance at all. And, indeed, how many times are the material producers called in and given a chance to tell of the merits of their respective products. Wouldn't it be far better for the prospective home-builder to go to the architect's office with his mind made up?

Let us carry this a little further. We have built our home and our street is about to be paved. We will have a tax bill to meet. We are not consulted about the type of surfacing material which will be used, for only one reason: We cannot intelligently discuss it. We haven't been asked to a conference because we haven't insisted upon an invitation.

Arouse Interest of Civic and Business Groups

Have you ever attended an improvement association meeting? If you have, you know what interest is sometimes aroused there. Suppose the question of the relative merits of stone and competing materials is brought up there. If the only opportunity to sell the property owners on the advantages of crushed stone over other materials is presented there, that is better than none at all. But why wait until then? The municipal engineers may favor some other material. They may not afford such a chance. If they thought property owners were sufficiently interested, they would, of course, provide the opportunity. Wouldn't it be far better for the property owners to go to the

¹ Presented at the Fourteenth Annual Convention of the National Crushed Stone Association, held at the Hotel Jefferson, St. Louis, Missouri, January 19-22, 1931.

meeting with their minds made up? They could at least start something.

Of what are the boards of directors of banks, utilities and industries constituted? Just men. They build bank buildings and lend money on other buildings. They build office buildings. They build factory buildings. They use your material and that of others. Why not have a few boosters for stone on those directorates? Why await their election to directorates, why await the arrival of a problem concerning the merits of your material as compared with another material, before starting your educational campaign? Why not have your booster go on the board with his mind made up?

A minute ago, I enunciated the theory that the people ultimately get what they want. I said it was a broad theory. Just as the architect wants to please his client because it is the pleased client who means a profitable business, public officials want to please their constituency. In a pleased and satisfied constituency is where the votes are. In the business world, money counts. In the political world, votes count. Make the people want your commodity. In other words, grow your own demand.

Another asks: Will the people understand? My answer is: If you are in an industry which is beyond the comprehension of the people, you had better get out of it. The public is only curious about the Einstein theory, and curiosity sometimes kills. Ask cats. But it never lasts. Of course, the people will understand, especially if you try to make friends of them.

Supreme confidence in the people, confidence in their intellect, confidence in their integrity, confidence in their ability to discriminate, is the "Open Sesame" of making friends. A manifestation of this confidence by painstaking, patient and sympathetic overtures on your part is the surest way to the hearts of the people.

Commodity Should Be Humanized

In going about the task of making your industry popular, it should be remembered that your commodity should be humanized as much as possible. A great deal of showmanship will be necessary. Were it my responsibility, I would dramatize the industry for production on the stage of the world. In my play, stone would be the leading character. It would act the part of the great benefactor of the human race. People like to feel that their lives are being made more pleasant; that their burdens are being lightened; that their welfare, and particularly that of their children, is being safe-guarded. They react to the influences which stimulate such states of mind. In my play, I would make actors of you salesmen. I would cast you in roles supporting the main character. You would be servants of the human race. In this connection, let me recall for you the scriptural admonition: "And whosoever of you will be the chiefest, shall be

servant of all." (Mark 10:44). I shall have more to say about this a little later.

High Standards Necessary

In making your industry a living thing in the minds of the people, you must observe the ideals of life. Selfishness has eventually bankrupted many a big institution. If selfishness does not invariably lead to bankruptcy, it always leads to a community hatred followed by dire results. I recall an oil company which many years ago started out to grasp the whole market for itself. Its policy was followed by curbing legislation in the shape of anti-trust acts and expensive trust-busting litigation. Other industries suffered with it, which at all times follows. Ever since, this particular organization has been spending thousands of dollars annually trying to eradicate from the minds of the people the hatred and suspicion which it alone engendered in the public mind by its devastating conduct. How much better it would have been to have distributed all of this money in dividends. That it has learned its lesson—that it wants to appear before the people as a great benefactor with the highest moral purposes—is best evidenced by the deposition of its chairman, Colonel Stewart, for conduct thought to be unbecoming the head of such an institution.

This is not all. Everybody, every industry, has imitators, folks, lacking in originality, who want to excel at another's game. These imitators are like the poor. They are with us always. Starting where many finish, taking advantage of what has gone on before, sometimes their greed spurs them to beating the established record.

An old anecdote illustrates what a lust for gold will do. A friendly group was in social conclave at a bar. One of the drinkers remarked that he had just consumed a quail a day for fifteen days. Knowing that the group regarded the consumption of a quail a day for thirty days a rare feat, if not an impossibility, another of the drinkers ventured this:

"I know a chap who can eat a quail a day for thirty days."

"Bet you five hundred he can't do it," said the proud possessor of the fifteen day record.

"You're covered," answered the thirty day man's advocate.

The latter went down to the river front to search for his champion devourer. Locating him, this is what he said:

"Say, you can beat the record of eating a quail a day for fifteen days. You can eat a quail a day for thirty days, can't you?"

"Sure can," answered the boy with the big appetite.

"Fine," said the better. "I've just laid five hundred that you can do it. If we win, I'll give you half."

"Now, listen, pardner," announced the man who lived to eat, "If there's dough in it, bet him a thousand and make it geese."

(Continued on page 26)

« « E D I T O R I A L » »

Research Laboratory To Enlarge Its Activities

At the meeting of the Board of Directors held in Atlantic City last July, very serious consideration was given to the advisability of enlarging the research work of the Association, particularly with reference to investigations designed to develop further information with regard to railroad ballast and bituminous mixtures. Mr. Goldbeck was asked to investigate the possibilities of extending the scope of our research investigations and to make recommendations as to the funds required and the projects involved as early as possible. In conformity with this request, we prepared a detailed outline of research projects which the Association should undertake at the earliest opportunity. This information was presented to the Executive Committee and to the Board of Directors at the St. Louis Convention. The suggested program in its entirety obviously could not be undertaken at the present time due to lack of funds, but it was Mr. Goldbeck's estimate that the investigations proposed in connection with railroad ballast and bituminous mixtures could be conducted if an additional \$10,000 per year were made available. The Board of Directors has for a long time been keenly aware of the urgent necessity of enlarging our research activities to include investigations along these lines, it only being a question of obtaining the additional revenue necessary to accomplish this. At the meeting of the Board in St. Louis the President was authorized to take such steps as he might deem wise and effective to raise by subscription the sum of \$10,000 for accomplishing this purpose.

As soon after the convention as possible President Worthen called a meeting of the Executive Committee to be held in Washington on March 12, largely for the purpose of determining the most desirable course to pursue to raise the additional \$10,000 needed. It was considered by the Executive Committee to be unwise at the present time to make a specific appeal to the general membership for subscriptions to this fund. After thoroughly considering the matter, it was felt that the most satisfactory means for expeditiously raising the funds would be to appeal directly to the members of the Board of Directors, and consequently the President was authorized to write to each member of the Board asking that he subscribe \$250 towards a \$10,000 fund to be used solely and exclusively for the purpose of enlarging the scope of our research investigations. A letter has recently gone forward to

all members of the Board over President Worthen's signature asking for these subscriptions and the response which has been received to date is most gratifying.

It is realized that there are many member companies of the Association not represented on the Board of Directors which are particularly sympathetic to the needs of the Association for increasing its research activities and which because of this will desire to assist in raising the required \$10,000. It would be unfortunate if the members at large felt that subscriptions to this fund would be received only from members of the Board of Directors and obviously the burden of raising the additional money should not fall exclusively on their shoulders. Therefore, in order that the raising of this fund may be assured we invite all members of the Association who feel the need of increasing our research activities along the lines suggested to send their subscriptions in whatever amounts they may feel justified in giving, to President Worthen. Your cooperation and generous assistance will be very much appreciated.

It should be interesting to the membership to know that on the basis of funds already subscribed, investigations are at present being conducted to develop further information with regard to the use of crushed stone as a railroad ballast material.

Byron T. Van Camp

It is with very real regret that we announce the death of Byron T. Van Camp, President of the Van Camp Stone Company of Cincinnati, Ohio. Mr. Van Camp has long been a member of the National Crushed Stone Association and was particularly active in connection with the Cincinnati Convention as Chairman of the Reception Committee.

Mr. Van Camp was killed in an automobile accident on March 27 while traveling near Eaton, Ohio, with his son, Ralph, on their way to Grand Rapids, Michigan, for a week's holiday. He sustained a fractured skull and his son who was driving received cuts and bruises. Mr. Van Camp was sole owner of the Van Camp Stone Company and President of the Van Camp Sand and Gravel Company. He also represented The Barrett Company in Cincinnati in the sale of a tar binder used in macadam roads.

To his family, many friends and business associates, we extend our deep and heartfelt sympathy.

Team Work Brings Results

ELSEWHERE in this issue there is recorded the fact that the Hanover Quarry of the Bethlehem Steel Corporation marked the close of the year 1930 with the meritorious accomplishment of having completed the two preceding years with no lost-time accidents with a total exposure of 476,424 man-hours. A number of crushed stone plants during the last few years have established remarkable accident prevention records and to some this may therefore seem to be the announcement of but one more safety record.

Assuredly it is far more significant than that. The establishment of the record is of but secondary importance as compared to that which makes the record possible—team work. Accident prevention records cannot be made without team work and every employee of the plant, no matter in what capacity he may be employed, occupies a strategic and important position on the team. One error by even the least important of the players and the game is jeopardized. Cooperation and sympathetic understanding between the management and the foremen, between the foremen and the men, and between the men individually is the foundation upon which a successful accident prevention campaign is planned.

To the Bethlehem Steel Corporation and to the employees of its Hanover Plant, we extend our hearty congratulations, not only for the enviable record which they have made, but even more because of what such a record represents.

It lies within the province of each member of the National Crushed Stone Association to markedly contribute to the efforts which the Association is continuously making in its endeavor to decrease accidents. Unfortunately we have not as yet reached that state of perfection where all quarries can establish perfect safety records. Each and every individual plant operated by the members of the Association can, however, be entered in the National Crushed Stone Association Safety Contest. A communication regarding this contest was recently forwarded by the Washington Office to all members of the Association and it is our sincere hope that the membership will take seriously our suggestion that all plants be immediately entered in the contest. To do so entails but little effort on your part, while at the same time you are materially aiding the Association in its accident prevention work.

National Lime Association Adds to Staff

Announcement has recently been made by the National Lime Association, with headquarters at 927 Fifteenth St., N. W., Washington, D. C., of the appointment of Lee S. Trainor as Chief Engineer, Construction Division. This Division deals with the use of lime in the construction industry in mortar, plaster, stucco, concrete and similar materials.

Production of Crushed Stone in 1929

A TOTAL production of 92,721,260 tons of crushed stone during 1929 was reported to the United States Bureau of Mines, Department of Commerce, by 1,453 operating companies. This includes concrete aggregate, road metal, and railway ballast but does not include flux stone, agricultural limestone, and other crushed stone products.

In the following table the Bureau of Mines has tabulated the production figures in groups of companies (not individual plants) according to the tonnages they produced during the year.

A study of the table reveals the rather surprising fact that 869, or 60 per cent of all the companies produced less than 25,000 tons each, during 1929, and their total combined production was only 7½ per cent of the country's total.

Of the remaining 584 companies, all producing over 25,000 tons annually, 299, or 51 per cent, accounted for only 14.26 per cent of the total production.

Observed from another angle, 50 per cent of the United States production of crushed stone in 1929 came from 1369 companies. This means that 84, or less than 6 per cent, of the operating companies produced 50 per cent of the stone, and further, that these 84 companies all produced over 250,000 tons each.

Many other groupings of equal interest may be made by a study of the attached table.

Production of Crushed Stone in the United States in 1929

Tons	Companies			Production		
	Number	Per cent of total	Cumulative percentage	Tons	Per cent of total	Cumulative percentage
1-999	118	8.1	26.8	46,410	.05	.86
1,000-4,999	272	18.7	35.8	754,020	.81	2.17
5,000-9,999	175	12.0	38.8	1,213,570	1.31	3.89
10,000-14,999	132	9.1	47.9	1,590,940	1.72	5.64
15,000-19,999	96	6.6	54.5	1,626,100	1.75	7.47
20,000-24,999	78	5.4	59.9	1,697,800	1.83	14.67
25,000-29,999	191	13.2	73.1	6,674,990	7.20	21.73
30,000-34,999	108	7.4	80.5	6,543,220	7.06	21.73
35,000-39,999	60	4.1	84.6	5,065,630	5.46	27.19
40,000-44,999	35	2.4	87.0	4,083,390	4.40	31.59
45,000-49,999	49	3.4	90.4	6,601,010	7.12	38.71
50,000-54,999	22	1.5	91.9	3,543,610	3.82	42.53
55,000-59,999	12	.8	92.7	2,232,400	2.41	44.94
60,000-64,999	21	1.5	94.2	4,617,640	4.98	49.92
65,000-69,999	15	1.0	95.2	4,111,010	4.43	54.35
70,000-74,999	29	2.0	97.2	10,033,160	10.82	65.17
75,000-79,999	6	.4	97.6	2,533,650	2.73	67.90
80,000-84,999	12	.8	98.4	6,485,920	7.00	74.90
85,000-89,999	5	.4	98.8	3,132,640	3.38	78.28
90,000-94,999	3	.2	99.0	2,233,260	2.41	80.69
95,000-99,999	4	.3	99.3	3,339,610	3.60	84.29
100,000-1,099,999	3	.2	99.5	2,911,780	3.14	87.43
1,000,000-1,999,999	5	.4				
2,000,000-2,999,999	1	.5	100.0	11,640,500	12.57	100.00
3,000,000-3,999,999	1					
	1,453	100.0		92,721,260	100.00	

Notes of Interest to Aggregate Producers

(Continued from page 14)

These data indicate that 1.5 bbl. of cement per cu. yd. of concrete with 5% gal. of water using aggregate that passed a standard specification will give sufficient strength both in tension and compression to insure good concrete pavement.

There seems to be no good reason why concrete made with crushed stone should require from 0.1 to 0.2 bbl. more cement than that made with gravel as is the case with the 1:2:3.5 mix commonly used.

« « Manufacturers' Division—New Equipment Section » »

Traylor Engineering and Mfg. Co. offers New Reduction Crusher

A new reduction crusher is being offered to the trade by the Traylor Engineering & Mfg. Co., of Allentown, Pa. The machine, which is styled "The Type TZ," is designed with extra heavy proportions and built in six sizes capable of hourly production ranging from about fifteen tons, $\frac{1}{2}$ " ring size, in the smallest machine, to nearly one thousand tons $2\frac{1}{2}$ " ring in the largest size. This unusually wide range, the manufacturers feel, will meet any need.

The crusher is of the gyratory type with a bell shaped crushing head, and the concaves are sharply convexed from top to bottom of the bowl. This design the manufacturer claims eliminates choking because the normal choking point of a standard type gyratory crusher (at the bottom of the head) has been moved upward to a point where the tendency to choke disappears. This elimination of choking results in a higher rate of output and finer and much more uniform product with a reduced percentage of undersize.

The Traylor Type "TZ" Reduction Crusher is designed with a balance lever and tension springs to support the head and shaft, the springs being adjusted to a tension sufficient to withstand

coarsest setting is $1\frac{1}{2}$ ", the machine may be adjusted to break to $\frac{3}{4}$ " or anything between these limits.

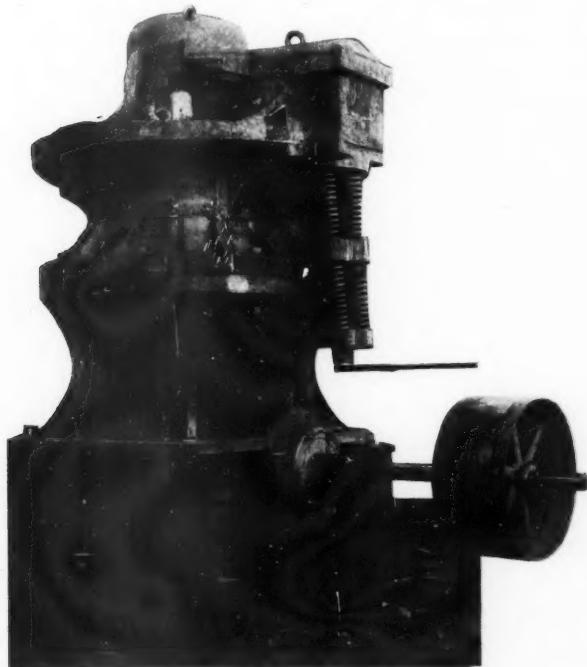
No feeder is required or should be used with the "TZ," as it operates most efficiently and delivers maximum tonnage when sur-charged or "flooded". The wear of the head and concaves, according to the manufacturer, is much less per ton of output than in any other type of crusher, and therefore the crushing surfaces hold the original shapes for a longer period of time than in other breakers, resulting in continuous uniformity of product and large capacity.

In general, the Type "TZ" Reduction machine possesses all of the tried and valuable features of the well and favorably known Traylor Bulldog Gyratory Crusher, including the bar-type non-weaving spider, the stocky, non-deflecting main shaft, the self-aligning eccentric bearing, the automatic lubrication system with all elements contained within a sealed chamber, and the positive and entirely reliable dust sealing device which excludes all dust and grit from the working parts.

Not the least feature and advantage of the new design is that at reasonable cost it may be applied to any existing gyratory crusher of any make and may be installed with or without the balance lever and tension springs. The effect of converting an old gyratory into a reduction crusher by installing the "TZ" type of head and concaves is to enormously increase the capacity at a smaller product size. The increase averages fifty to seventy-five per cent and there are some installations where the former capacity has been doubled with the product size less than that of the previous minimum setting.

The manufacturers feel that this new crusher is a very material contribution to progress in the rock products industry, because the machine has greater capacities than has been the case heretofore with cone type reduction machines, and the fact that adjustment is in a wider range and more easily accomplished. In addition, the adaptability of the design for converting old gyratory crushers, an exclusive feature, makes possible its use in many instances where conditions might not warrant the purchase of a new machine.

The Traylor Engineering & Manufacturing Co. has much data of interest to users, and many remarkable performance records, which it is anxious to present for the consideration of prospective purchasers. One of its representatives is immediately available on request from anyone interested.



15" Bulldog Finishing Gyratory Crusher

the downward thrust of the head due to crushing, and yet to allow the head to be depressed to a liberal degree.

The manufacturer says the "TZ" Crusher will receive and crush larger rock than any other cone type secondary reduction machine and the head may be accurately adjusted, during operation, for varying the size of product. The adjustment range in any one machine is fifty per cent—that is, if the original

New P&H $\frac{3}{8}$ Yd. Excavator

Harnischfeger Corporation announces a new $\frac{3}{8}$ yard excavator now being put into production in its plant at Milwaukee to be ready for Spring delivery.

This new machine, known as the Model 200-A, follows the same general design of the larger P&H's. It is sturdily and compactly built with a large proportion of alloy steels and is light enough to meet the demand for a convertible excavator weighing under fourteen tons. Hoist, swing, crowd, and travel speeds are unusually fast.

Corduroys (crawlers) employ the well-known P&H double sprocket drive on link pins instead of the links themselves. All machinery on the revolving frame is placed with a view to compactness but with full accessibility. Drums are mounted on separate shafts with the jack shaft assembly between. The entire gear train is located on the right side of the machine and runs in an oil bath. Shafts operating in excess of 40 R. P. M. are roller bushed. All clutches are of the internal expanding

type. Hoist and crowd clutches are interchangeable, as well as the five main outside type brake bands. Boom hoist is of the planetary type with automatic safety load brake.

A four or six cylinder 45 H. P. gasoline engine furnishes ample power and provides unusual acceleration and speed.

The patented P&H chain crowd appears on the Model 200-A in a highly perfected form. The dipper can be returned at more than twice the speed it is crowded out. Raising and lowering the boom does not disturb the adjustment of the crowd chains.

The P&H Model 200-A shovel is standard with a 17' boom and 12' dipper sticks giving a total dumping height below door of



17'. The dragline and crane booms are of lattice box section design with a standard length of 30'. The machine is fully convertible for shovel, dragline, clamshell-crane, trench-hoe, or skimmer-scoop operation.

An outstanding feature of the Model 200-A is its ease of operation. By means of power clutch control and very responsive brakes, the machine can be manipulated as easily as an automobile.

A substantial fully enclosed steel cab is standard equipment. The entire machine is finished in a durable dark green enamel.

Further information will be gladly provided upon request to the Harnischfeger Sales Corp., Milwaukee, Wisconsin.

Stephens-Adamson Mfg. Co. Issues New Booklet

Stephens-Adamson Mfg. Co. of Aurora, Illinois, has just published a 10-page booklet describing their conveyors, elevators, hoppers and batching equipment for central proportioning and concrete mixing plants. The book contains diagrams of typical plant arrangements and features a new automatic photoelectric cell control for increasing the accuracy and economy of concrete mixtures. Copies will be gladly sent to those who are interested.

Tight Butt Joint Demonstrated



When the photographer climbed up to take this picture he found a puddle of water over the joint. It had rained the previous evening. Obtaining a broom he swept out most of the water, but a little still remains to prove the manufacturers' claim that Flexco HD Belt Fasteners make a tight butt joint that is tight, not only preventing leakage of solid materials through the joint, but liquids as well.

This belt handles 600 tons of crushed stone, coal or lime per hour with a maximum capacity of 1,000 tons. Width 48 inches. Speed 450 ft. per minute. Joined with Flexco HD Belt Fasteners size 1½, which are manufactured in steel or non-rusting Monel Metal by Flexible Steel Lacing Company, 4625 Lexington Street, Chicago.

Good Roads Save 2.6 Per Mile

WHAT does it cost to run an automobile? The question is often asked, and there are many answers. The cost depends on the type of road on which it is operated, the size and type of machine, and the manner in which it is operated. Many car owners keep complete records of their car costs, and they all agree that the cost of running a car has been greatly reduced since the good roads movement began in earnest.

Since it is impossible to improve all roads at once, most cars must be operated part of the time on good roads and part of the time on roads which are only fair or poor. Every car owner knows that he uses more gasoline on a poor road than on a good one, but it is obviously impossible for him to measure tire wear on each trip. The engineering and agricultural colleges of several states, Iowa foremost among them, have made detailed studies of the cost of each item, on different kinds of roads and with various kinds of cars.

These studies have been combined into one table, giving the cost of running an imaginary "average" passenger automobile. This table, published in the "Highways Handbook," issued by the Highway Education Board, Washington, D. C., gives the following figures:

Item of Cost	Approximate Relative Cost of Operation in Cents Per Mile		
	High type roads	Intermediate type roads	Low type roads
Gasoline	1.09	1.31	1.61
Oil	0.22	0.22	0.22
Tires and Tubes	0.29	0.64	0.84
Maintenance	1.43	1.72	2.11
Depreciation	1.26	1.39	1.57
License	0.14	0.14	0.14
Garage at \$4 per month	0.44	0.44	0.44
Interest at 6 per cent	0.36	0.36	0.36
Insurance	0.21	0.21	0.21
Total cost	5.44	6.43	7.50

The compilation is based on an annual mileage of 11,000. Some of the items, such as garage, interest, insurance and license, are the same regardless of how much the car is used. If a car is used only 5,500 miles a year, the cost per mile for these items would be doubled.

By "high type" roads are meant roads of concrete or other material not affected by moisture or drought, "intermediate" types are roads which are graded and graveled to modern standards, and low type roads include earth roads and gravel roads which are not properly graded and drained.

Some Current Aspects and Probable Future Developments in the Agricultural Limestone Project

(Continued from Page 10)

calcium or dolomitic; whether it should be finely ground or relatively coarse, therefore depend upon, first, the analysis of the individual soil and, second, the promptness which is expected in results. Is the purpose to help the next succeeding crop or is it a part of a long time soil building program? The cost of transportation, unloading and distribution on the farm, as well as the cost of the limestone itself, all have a direct bearing upon the question: "What is the most economic grade of material and at what rate of application per acre to get results?"

Much valuable research work has been done at the various agricultural experiment stations but unfortunately they have worked too much independently of each other. For instance, the laboratory screens which have been used for measuring fineness of grinding in some cases have no relation to any recognized standard. In a number of cases the series 10-20-40-60-80 and 100 mesh have been used without any recorded reference to the make of the screen or the sizes of the openings. The mere numerical relationship does not reflect any actual relationship in the size of particles being tested. Some effort should be made at a co-ordination of such research work and a co-interpretation of results. Future experiments should be related to some recognized standards and to the usages of the engineering and construction industries.

I mention all these things only to show the unlimited field which lies before you for constructive effort wherein you not only can help agriculture but should receive a generous reward yourselves in so doing.

I feel that the agricultural limestone side of your industry can well afford to be better organized; to participate in research work, not as a means of finding sales arguments but as a means for developing impartial facts to which your industry must adjust itself sooner or later. I feel that you can well afford through organization to strive toward standardization of: first, grades of material; second, market methods; third, public relations. Also that through organiza-

tion you can accomplish much more by institutional advertising and through constructive education, than you can accomplish through individual, competitive, market advertising and through inadequately following, instead of leading, in the educational work.

You may not agree with me in some of the statements I have made or the suggestions I have set forth. They are but the viewpoint of one man and may or may not have much merit; but in concluding I wish to express the hope that at least they will have stimulated independent thought on your part and have contributed in some small way toward the final solution of a problem which threatens to become more and more serious if not promptly solved. Whether or not your industry is profitable to those in it, the fact is that it is of fundamental importance to our nation's welfare and you need make no apology to the rest of the business world for your existence. You are deserving of a more prominent place in the sun and I hope that in the years to come you will be able to achieve that place. Thank you.

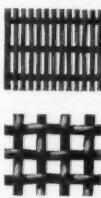
"A Single Breaker May Recede—but The Tide Is Coming In!"

To make the most out of 1931, introduce into your business the best new blood you can. Conditions today present golden opportunities. Now is the time to strengthen organization. Strong executives, well-qualified technical men are available. Leaders who would take advantage of this situation should consult THE NATIONAL ENGINEERING SOCIETIES and AMERICAN TRADE ASSOCIATION EXECUTIVES. These organizations have rosters of surprisingly well-qualified men of splendid training and success.

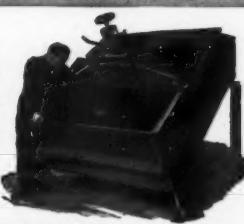
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Mitco Armorgrids*

Popularizing An Industry

(Continued from Page 20)

It is one thing to legitimately get as much business as you can. This is morally right.

It is quite another thing to annihilate another. This is morally wrong.

Without discoursing thus any further, the point I am trying to make is this: To popularize an industry, it must set for itself the standards of morality that human beings can understand. That morality is the same as that which they, in idealizing, set for themselves. In only this way can your industry envelop itself in the affections of the people. And, I might add, basking in the amiability of the populace ought not to be so difficult, since all of us from childhood were taught in a patriotic hymn, to sing, "I love thy rocks and rills."

You men have studied the aims, the ideals, the hopes of your industry. All of you have to a greater or less degree embodied those aims, ideals and hopes in your very selves. Perfect yourselves so that you may be able better to convey these aims, ideals and hopes to the populace. Your medium is personal contact, the various journals of the country and the radio. If you do not carry your message, how is the busy populace to learn about those aims, ideals and hopes? In what better way could you serve your industry and the populace? In no other way can the industry be popularized.

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HD Belt Fasteners

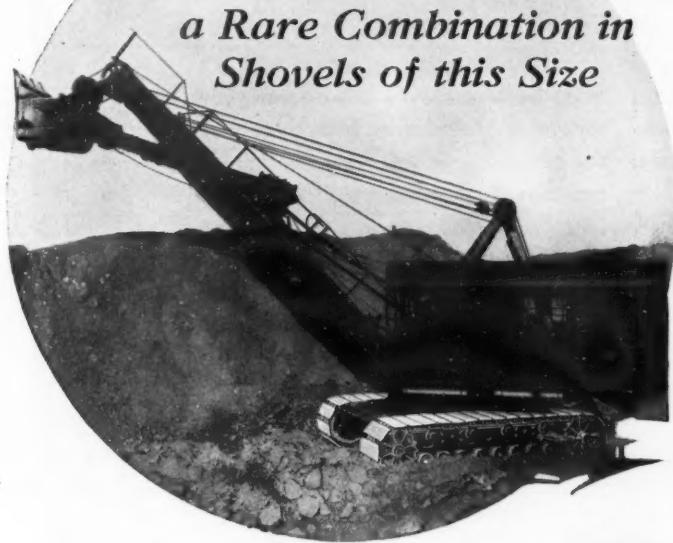
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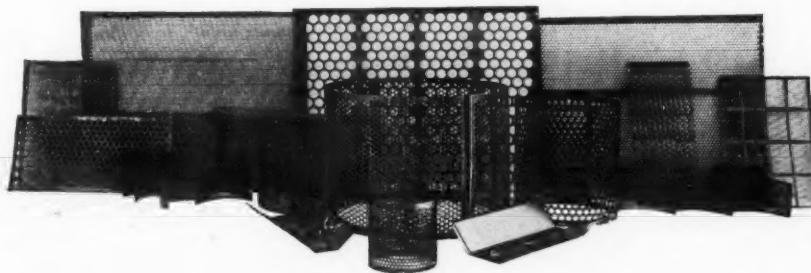
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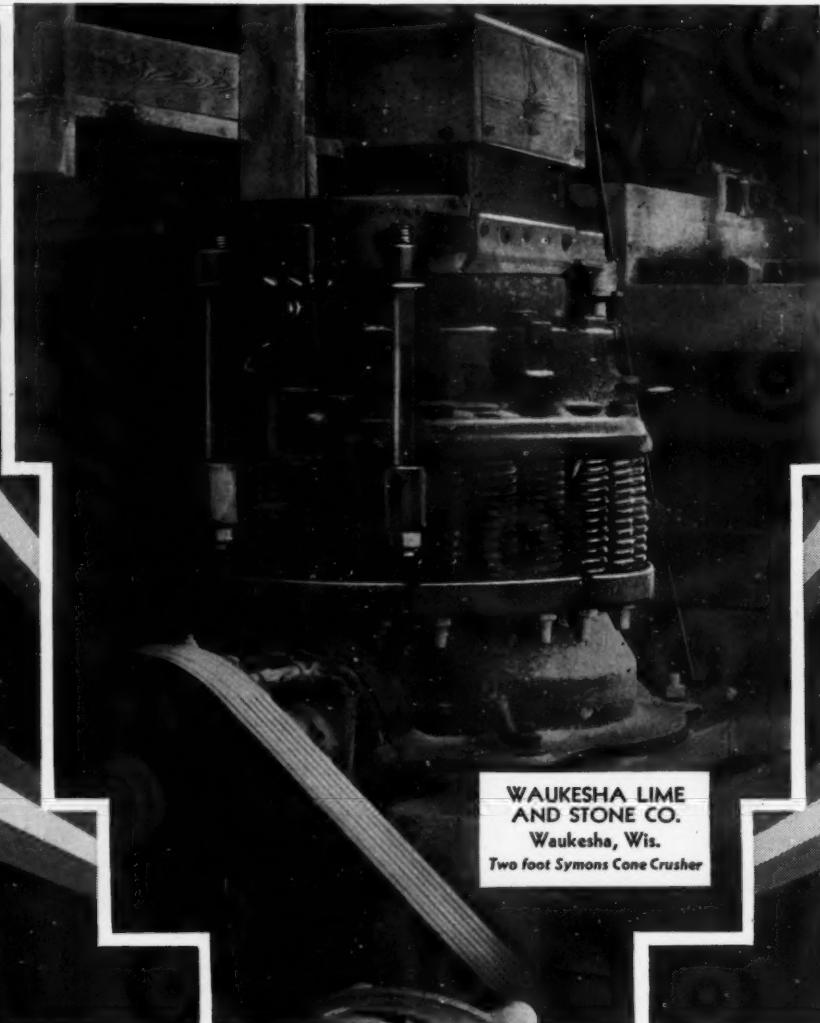
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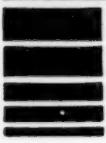
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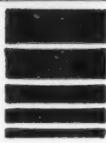
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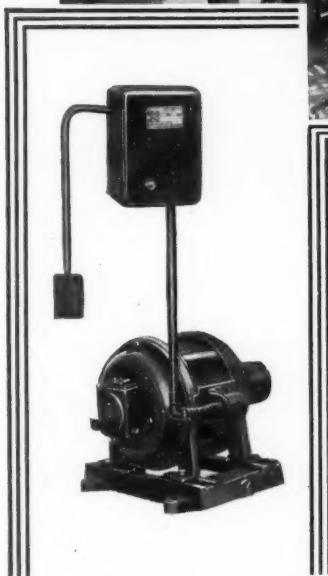
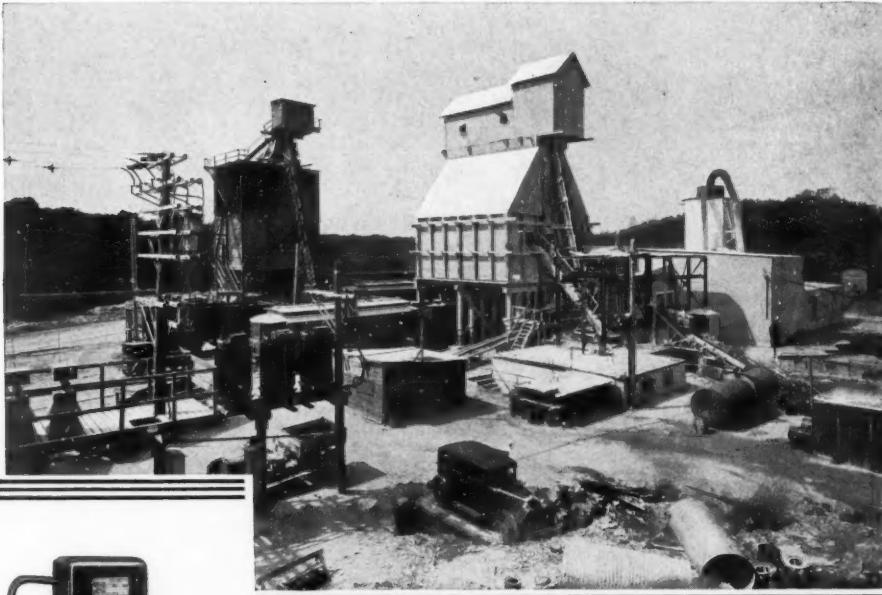
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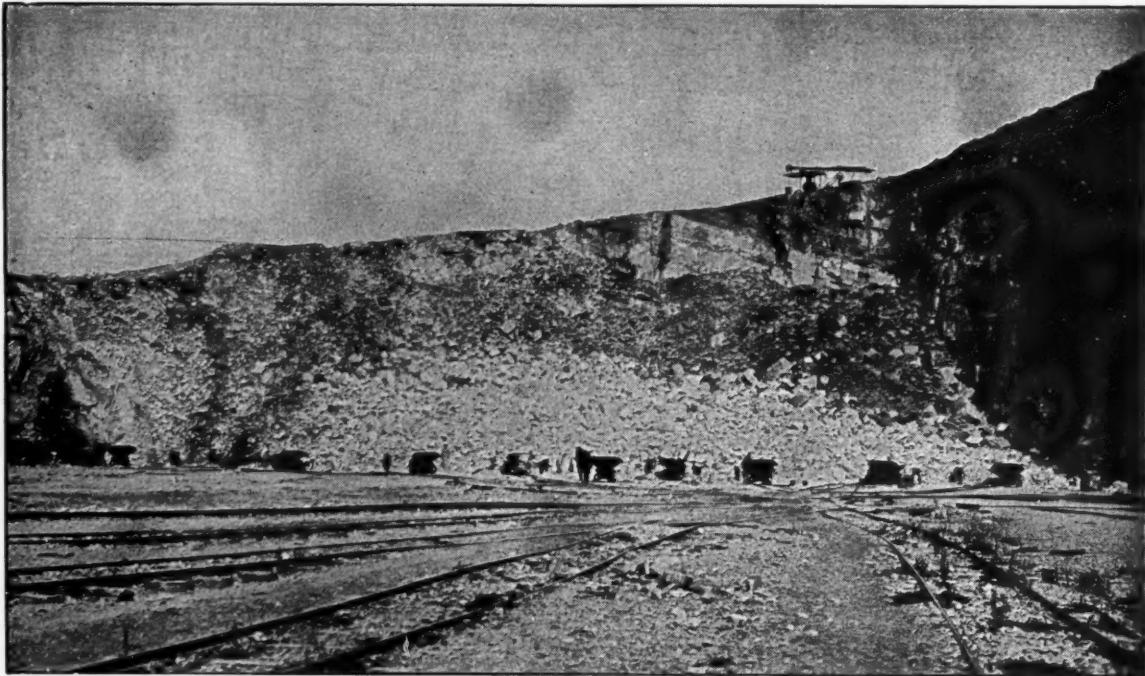
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